DOCUMENT RESUME

ED 439 939 SE 063 380

AUTHOR Huinker, DeAnn; Pearson, Gretchen; Posnanski, Tracy; Coan, Cheryl; Porter, Corrie
TITLE First Year Site Visits to Milwaukee Urban Systemic Initiative Schools. A Report on the Milwaukee Public Schools Milwaukee Urban Systemic Initiative.
INSTITUTION Wisconsin Univ., Milwaukee. Center for Mathematics and Science Education Research.
SPONS AGENCY National Science Foundation, Arlington, VA.
PUB DATE 1998-08-00
NOTE 89p.; For another report from the Center for Mathematics, see SE 063 381-384.
CONTRACT ESR-95-54487
AVAILABLE FROM University of Wisconsin-Milwaukee, Center for Mathematics and Science Education Research, School of Education, 265 Enderis Hall, Milwaukee, WI 53201-0413.
PUB TYPE Reports - Research (143) -- Tests/Questionnaires (160)
EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS Academic Standards; *Educational Change; Elementary Secondary Education; Equal Education; *Mathematics Achievement; Mathematics Instruction; Mathematics Teachers; Principals; Questionnaires; *Science Achievement; Science Instruction; Science Teachers; State Programs; Student Attitudes; Teacher Attitudes; Teaching Methods; Urban Schools
IDENTIFIERS *Milwaukee Public Schools WI; Systemic Educational Reform

ABSTRACT

The Urban Systemic Initiatives (USI) program is an effort sponsored by the National Science Foundation (NSF) that targets large urban school systems with the goal of sustainable implementation of high-quality, standards-based teaching for the purpose of attaining system-wide increases in students' learning of challenging mathematics and science. The Milwaukee Public Schools joined USI in 1996 with the Milwaukee Urban Systemic Initiative (MUSI). The goal of this report is to contribute data to the formative evaluation of MUSI. It consists of information obtained from 1997 site visits to the First Wave schools towards the end of the first year of implementation. The purpose of the site visits was to develop an understanding of the science and mathematics program at each school and to gain an understanding of the impact of MUSI. Site visits were conducted at 18 of 51 First Wave MUSI schools which consisted of eight elementary, six middle schools, one K-8 school, and three high schools. Criteria for site selection included: (1) diversity of representation according to level; (2) diversity of geographic location; and (3) no two schools serviced by the same Mathematics and Science Resource Teacher (MSRT). Conversations with students, teachers, and principals and classroom observations are reported. Major findings were highlighted in the areas of student and teacher tools and materials; student grouping arrangements and equity; student engagement tasks, and activities; and connections which focused on the presence of connections between students' lives, subject areas, careers, and culture. (Appendices contain a list of First Wave Schools, general guidelines for conducting a site visit, guidelines for being a team leader, a classroom

Reproductions supplied by EDRS are the best that can be made
from the original document.

observation form and checklist, and 3 interview protocol forms for students, teachers, and principals.) (ASK)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 439 939

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☒ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

SCOPE OF INTEREST NOTICE
The ERIC Facility has assigned this document for processing to: S
In our judgment, this document is also of interest to the Clearinghouses noted to the right. Indexing should reflect their special points of view. U

First Year Site Visits to Milwaukee Urban Systemic Initiative Schools

A Report on the Milwaukee Public Schools Milwaukee Urban Systemic Initiative

DeAnn Huinker
Gretchen Pearson
Tracy Posnanski
Cheryl Coan
Corrie Porter

mps

UWM

SE063380

BEST COPY AVAILABLE

First Year Site Visits to Milwaukee Urban Systemic Initiative Schools

A Report for the Milwaukee Public Schools
Milwaukee Urban Systemic Initiative

DeAnn Huinker
Gretchen Pearson
Tracy Posnanski
Cheryl Coan
Corrie Porter

August 1998

Center for Mathematics and Science Education Research
School of Education, 265 Enderis Hall
University of Wisconsin-Milwaukee
Milwaukee, WI 53201-0413
414-229-6646 / 414-229-4855 fax

This material is based upon work supported by the National Science Foundation under Cooperative Agreement No. ESR-95-54487. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Contents

Chapter 1. Introduction 1
Background
Procedures

Chapter 2. Conversations with Students 5
Math Class
Science Class
Ideal Math and Science Class
Individual Work or Group Work
Why Study Math and Science
Materials, Tools, and Technology
Who Helps You
Student Perceptions of Teachers' Attitudes
Other Student Comments and Questions
Summary

Chapter 3. Conversations with Teachers 21
Mathematics and Science Lessons
Standards-Based Teaching
Needed Resources
Technology
Assessment Strategies
Performance Gap
Professional Development
Opportunities for Teachers to Interact
Impact of the Milwaukee urban Systemic Initiative
Other Comments
Summary

Chapter 4. Conversations with Principals 35
Involvement with MUSI
Strengths and Weaknesses in Mathematics and Science
Student Achievement and Learning
Standards-based Mathematics and Science Instruction
Community support for mathematics and science programs
MUSI and the Mathematics/Science Resource Teacher
Summary

Chapter 5. Classroom Observations 49
Elementary School Mathematics
Elementary School Science
Middle School Mathematics
Middle School Science
High School Mathematics
High School Science
Summary

Appendix A. First Wave MUSI Schools 71

Appendix B. Site Visit Guide 73

CHAPTER 1

INTRODUCTION

BACKGROUND

The Urban Systemic Initiatives (USI) Program is sponsored by the National Science Foundation. It is a comprehensive and systemic effort to stimulate fundamental, sweeping, and sustained improvement in the quality and level of K-12 education in science and mathematics. The USI program focuses on the cities with the largest numbers of school-aged children living in poverty, as determined by the 1990 Census. Milwaukee is one of these cities.

The USI challenge is to provide high quality, rigorous mathematics and science education to all students in the district. The following are referred to as "drivers" or critical elements that must occur for success in this effort.

- Implementation of comprehensive, standards-based curricula as represented in instructional practice, including student assessment, in every classroom, laboratory, and other learning experience provided through the system and its partners.
- Development of a coherent, consistent set of policies that support: provision of high quality mathematics and science education for each student; excellent preparation, continuing education, and support for each mathematics and science teacher (including all elementary teachers); and other learning experiences provided through the system and its partners.
- Convergence of the usage of all resources that are designed for or that reasonably could be used to support science and mathematics education fiscal, intellectual, material, curricular, and extra-curricular -- into a focused and unitary program to constantly upgrade, renew, and improve the educational program in mathematics and science for all students.
- Broad-based support from parents, policy makers, institutions of higher education, business and industry, foundations, and other segments of the Community for the goals and collective value of the program, based on rich presentations of the ideas behind the program, the evidence gathered about its successes and its failures, and critical discussions of its efforts.
- Accumulation of a broad and deep array of evidence that the program is enhancing student achievement, through a set of indices that might include achievement test scores, higher level courses passed, college admission rates, college majors, Advanced Placement Tests taken, portfolio assessment, and ratings from summer employers, and that demonstrate that students are generally achieving at a significantly higher level in science and mathematics.
- Improvement in the achievement of all students, including those historically underserved.

The Milwaukee Public Schools (MPS) joined the USI effort in 1996 and began the Milwaukee Urban Systemic Initiative. MPS had a student population of approximately 106 000 students in 1996-97. The student population consisted of approximately 80% minority students—61 percent African American, 12 percent Hispanic, one percent Native American, five percent Asian, 20 percent Caucasian, and one percent other. Seventy-five percent of the students received free lunch. The district employed a total of 9537 school-based staff members of which 6507 were teachers. The district had 163 schools—114 elementary schools, 22 middle schools, 18 high schools, and 9 alternative schools.

The Milwaukee Urban Systemic Initiative (MUSI) includes three components. The first component involves mobilizing and supporting communities of learners at all levels—classrooms, schools, district, and city. The second component is the development of a core of teacher leaders, Mathematics and Science Resource Teachers (MSRT), to work directly with school communities The third component is the establishment of a mathematics, science, and technology center. For the first year of implementation in 1996–97, 51 schools became designated as the First Wave MUSI schools. Twenty-five MPS teachers were selected as Mathematics and Science Resource Teachers (MSRT). Each MSRT, with one exception, was assigned to two schools with the intention to work with the appointed schools for two years.

The purpose of this report is to contribute data to the formative evaluation of the Milwaukee Urban Systemic Initiative (MUSI). It consists of information obtained from site visits to the First Wave schools towards the end of the first year of implementation.

PROCEDURES

In April 1997, site visits were conducted at a sample of First Wave Schools. The purpose of the site visits were to develop an understanding of the science and mathematics programs at each school and to gain an understanding of the impact of MUSI.

Site visits were conducted at 18 (35 percent) of the 51 First Wave MUSI schools: eight elementary schools, six middle schools, one K-8 school, and three high schools. Criteria for site selection included: (a) diversity of representation according to level, (b) diversity of geographic location, and (c) no two schools serviced by the same MSRT.

Data was collected by site visit teams. Each team was comprised of four individuals, in most cases three educators and one community member. The team members varied from site to site, with most individuals conducting at least site visits to at least two different schools. This varied team composition provided multiple perspectives of each site visit.

To manage the logistics of the visits, a team leader was designated for each team. Site visit teams spent one half day at each site collecting data through observations and interviews. Teams collected data through the following activities:

- Interviews with two groups of approximately three teachers each,
- Interview with one group of six students,
- Interview with the principal, and
- Observations of four classes, two mathematics and two science.

Data collection instruments were based upon those used in the self-study of mathematics and science education in the Milwaukee Public Schools in preparation for becoming a USI site. Directions and instruments were compiled into a Site Visit Guide (see Appendix B). Site visit teams participated in a training session in the use of the instruments and guides.

Interviews

One group of students was interviewed at each site visit school for a total of 18 groups. All together 93 students were interviewed; 47 students from elementary schools, 29 students from middle schools, and 17 students from high schools. Demographic information was not available for two of the schools and the grade level for one student was not recorded. Of 87 students interviewed with available demographic data, 52 percent were females and 48 percent were males. Forty-eight percent of the students were African American, 39 percent were Caucasian, ten percent were Hispanic, two percent were Asian, and six percent were from other ethnic groups.

Two groups of teachers were scheduled to be interviewed during each of the site visits to first wave MUSI schools. Thirty-five groups of teachers were interviewed for a total of 92 teachers. One group interview was canceled due to unexpected conflicts. Of the 92 teachers, 50 were elementary school teachers, 24 were middle school teachers, and 18 were high school teachers. Thirty-three percent of the teachers were male and 67 percent were female. Twenty-one percent of the teachers were African American, nine percent were Hispanic, sixty-seven teachers were Caucasian, and three percent were of other race/ethnicity.

Individual interviews were conducted with the principal at each site visit school. Three high school principals, six middle school principals, one K-8 principal, and eight elementary school principals participated in the interviews. Eight principals were African American and 10 principals were Caucasian. Eight principals were male and 10 principals were female.

One member of the site visit team conducted the interviews using an interview guide that consisted of open-ended questions. (See the Site Visit Guide in Appendix B.) Each interview was approximately 20 to 30 minutes long. The interviews were recorded on audio tape. During the student and teacher interviews another member of the site visit team took extensive notes and the audio tapes were used to clarify and extend the written notes. The principal interviews were transcribed. The data were read and summarized by question or emergent themes and illustrative comments were identified to generate three sets of interview summaries—students, teachers, and principals. The summaries and themes were gleaned from the analysis of the interview data. These summaries and themes should be considered as representative of ideas expressed by the participants.

Classroom Observations

Observations of students learning mathematics and science were conducted in the site visit schools. Observations were scheduled for two mathematics classes and two science classes in each school. Scheduling allowed two additional classes to be observed in the schools for a total of 74 classroom observations. The distribution of observations across grade levels and content area are show below.

Level	Mathematics	Science	Total
Elementary School	18	16	34
Middle School	12	13	25
High School	6	9	15
Total	38	36	74

Observations of mathematics and science lessons usually occurred for an entire class period. Observers made written notes using a classroom observation guide (see Appendix B). The guide focused on eight areas: (a) tools and materials, (b) classroom environment, (c) equity, (d) student engagement, (e) instruction, (f) student focus, (g) connections, and (f) assessment. For each classroom observation, the observers responded to the questions and items on the guide and provided additional information through an observation checklists.

The completed observation forms were separated into elementary, middle, and high school levels and then further separated by content area. Then several readings of the completed observation forms occurred. Matrices were used to summarize the data for each level by subject area and to look for emerging themes. Illustrative examples of observer comments were identified to support the summaries.

CHAPTER 2

CONVERSATIONS WITH STUDENTS

During each of the site visits to first wave MUSI schools, a group of students was interviewed. A total of 18 groups of students were interviewed. Each group consisted of five to six students. The students represented a range of grade levels. They discussed both mathematics and science for about 30 minutes. All together 93 students participated in the conversations; 47 students from elementary schools, 29 students from middle schools, and 17 students from high schools. Demographic information was not available for two of the schools and the grade level for one student was not recorded. Of 87 students interviewed with available demographic data, 52 percent were females and 48 percent were males. Forty-eight percent of the students were African American, 39 percent were Caucasian, ten percent were Hispanic, two percent were Asian, and six percent were from other ethnic groups.

One site visit team member facilitated each conversation while another took extensive notes. The conversations were also audio taped. The tapes were used to clarify and expand on the written notes. The interview questions are stated below. A summary of responses is given for each question, followed by a listing of representative student comments. Because the interviews were conducted in small groups, each bullet is usually a compilation of comments from several students.

MATH CLASS

I am going to show you something and then I'm going to ask you to tell me what came to your mind when you saw that. Ready? (A card with "math class" written on it was shown to the students.) What did you think of when I showed you the card with math class written on it?

Elementary school students most frequently commented about specific math topics such as addition, subtraction, multiplication, division, numbers, fractions, and decimals. Approximately half of the students commented that they like mathematics or at least find it "easy." While the other half commented that math is often "boring, time consuming, and hard." In addition, a few students made comments concerning how important mathematics was for their future success in high school and for future jobs. Very few students thought of their math class as a hands-on learning experience.

The middle school students often responded with mathematics topics or individual attitudes toward mathematics. Many named topics like numbers, symbols, expressions, and problems. The various attitudes expressed by the students ranged from good, okay, and I like algebra to difficult, crazy, kind of hard and boring. One student mentioned the word "homework" while another expressed that he didn't like their student teacher.

High school students frequently thought of specific mathematical content areas when asked what came to mind when they thought of math class. The areas mentioned consisted of trigonometry, advanced algebra, algebra, geometry and more specific concepts such as sine, cosine, and hypotenuse. Several also thought of doing problems. A number of students mentioned that they liked math, that it was interesting, that it was their best subject, or that it was easy for them. On the other hand, approximately the same number of students commented that they thought math was boring, too hard, or they did not like it.

Elementary School Student Comments

- When I think of math class, I think of the world because most of the things in the world, like when you have to get a job, most of the time you need math, like adding and subtracting, finding the problem and solving it.
- If you don't understand something you have to keep going over and over it again.
- I think of patterns, numbers, sums, concepts, volumes, different shapes, figures, area, perimeters, addition, subtraction, multiply, and divide.
- I think it's really useful having a teacher from another school come in and teach us.
- It's boring. It's hard. Numbers. I like math. It's time consuming.
- Happy. I like math. I like multiplying.
- I have to really think hard to get the answer right.
- I see different signs, all kinds of numbers. Kids raising their hands. Kids at the board doing division. Kids answering questions from the teacher.

Middle School Student Comments

- Don't like problem solving. It's difficult. Crazy. Our teacher encourages us to do more. Word problems are hard. I like algebra.
- I don't like math. It's my favorite subject.
- Words. Math book. Doing problems. Just the words. Math is my best subject. It's easy.

High School Student Comments

- I know that the first class wasn't so easy, but now with computers, it makes it much clearer. We're using the PUMP Program. It's a lot easier. It's more fun.
- Algebra. Boring. Hard. Easy. Interesting. I like the teacher.
- Cosine and sine is fun when I get them. They're not easy until I begin to understand. Memory stuff. Computers, the PUMP.
- Don't like math. It's too hard. Boring. It's my weakest subject.

SCIENCE CLASS

I am going to show you something else, and then I'm going to again ask you to tell me what comes to your mind when you see this word. "A card with "science class" written on it was shown to the students.) What did you think of when I showed the card with science class written on it?

When elementary students were asked what they thought of when they saw the words "science class," by far the most frequently mentioned theme was "hands-on" types of experiences. Specific experiences included experiments and projects. In addition, the students often described their science class as a time when they could discover things, explore new ideas, and in general just get to do fun things. Many students also related the words "science class" with objects such as beakers, chemicals, rocks and minerals, and electricity. At the elementary level, all of the students' comments were more positive about science than mathematics, and they indicated that they "like science," "it's fun," "cool," and "exciting."

The middle school students interviewed mostly expressed their attitudes toward science when asked what came to mind when they saw the words "science class." Approximately half of the students indicated that they enjoyed science for reasons similar to the elementary students, however, there were a significant number who expressed that they thought science was boring or too hard. Some reasons given for why students felt negatively about science included issues about their teachers or boredom with how their science class was taught. Several students did, however, mentioned the words experiments, chemicals, and dissecting indicating that some science classes were associated with hands-on activities.

High school students most frequently mentioned their feelings and attitudes toward science when asked what first comes to mind when they see the words "science class." The majority of the students commented that they liked science. Only one student thought of it as being boring. A number of students mentioned the words "experiments" and "dissections," again associating science with hands-on types of activities. Many of the students told the interviewers about specific projects they had worked on in their science classes.

Elementary School Student Comments

- Exploring things. Chemicals. Bunsen burners. Beakers. Graduated cylinders. Finding new things. Solving problems. Mixing stuff to see what happens.
- In math you have to write everything, you have to write down a lot of stuff, and in science you don't have to write down everything.
- Science is fun!
- It's fun. Experiments. Projects. Exciting. Cool. You get to do lots of fun things.
- Discovery. Colors. Seeing where things come from.
- Experiencing things you never knew.
- Fun. After school science club. Computers. Animals. Measuring. Made an engine. Teachers help you out. Can do a project anytime.
- Blowing up things. Discovering things. Seeing where things come from. Digging up rocks. Discovering colors. Hikes. Studying things.

Middle School Student Comments

- It's hard. Doesn't seem like science stuff. The class is bad, so we don't get to do much. Bad, the teacher's mean. Boring. Good. Get to do experiments all the time.
- Fun. Experiments. Projects. Using hands. We get to do new and different things. Find something new all the time. I like experiments. Science Fair.
- Good. We get to do experiments all the time.

High School Student Comments

- Fun. Exploration. Experiments. Cutting up stuff.
- I love science. Science is very interesting. Science is boring, all we do is take notes.
- To me I like science, science is easy to me. It is really easy. When I think of science I think easy and fun.
- We are talking about animals. We are doing classification and sub-class. We are going to start mammals and reptiles.

IDEAL MATH AND SCIENCE CLASS

I would like to pretend that you are in control of your math and science class. You can decide what is taught and how it is taught. You are still in the class, but you make the plans for this ideal class.

If elementary students had control of their mathematics and science classes, they would utilize more creative techniques geared to help students learn. The various techniques suggested included making charts, having students work at the board more, have students teach lessons, give more examples of why math is useful, and more science experiments. Some students suggested that there should be more math games, while others felt that math needed to be more challenging but to start out teaching the easy concepts and gradually make the problems more difficult. If given the choice, students would choose to practice geometry, fractions, and decimals in mathematics class and study the environment, such as the earth, animals, and plants in science class.

If middle school students had control of their mathematics and science classes, most students suggested changes in the teacher's role, teacher techniques, types of activities, and amount of homework. When it came to a question regarding what the teacher would be doing, the majority of the responses indicated that the teacher would not lecture or talk as much, instead, students wanted the teacher to listen more, sit and grade papers, do activities with the class, or let students teach more. Specific techniques suggested by the students included guest speakers, more group work, and more games. A few students suggested instead of getting so much homework, they should have problems of the week to work on outside of class.

If high school students had control of their mathematics and science classes they would include more hands-on activities such as games, computer work, projects, and labs. Their teachers would also be more involved, energetic, and excited about mathematics and science and be more understanding of students' personal issues.

This question contained five prompts which individually addressed the areas of mathematics and science. Students' comments are listed below for each of the specific prompts.

Ideal Math Class

If you could describe your ideal math class, what would you be doing?

Elementary School Student Comments

- Do fun things and then get serious and then get fun again. Teach what's easy at the beginning and then get hard.
- More hands-on stuff. We would have teams that go up to board and solve problems.
- Make it more challenging, that's fun. It's boring if it's not challenging. Make more fun with games and activities.

Middle School Student Comments

- Learn about a variety of things. Pass out an envelope with math problems inside.
- Do more activities instead of worksheets. We'd have no homework, instead have a problem of the week.
- Do things that are challenging, not boring. Play math games. More graphing. Competition. Let kids teach.

High School Student Comments

- Teach more exciting ways. More projects. More real-life opportunities.
- Need more examples, not just worksheets. Make it fun, hands-on learning experiences, not just note taking. Things should be relevant.
- More games like in sixth and seventh grade. Play a game just before test review. Vary routine. Make it more exciting. Get more students to participate.

What would your teacher be doing in your ideal math class?

Elementary School Student Comments

- The teacher should do something that catches our eye and teach math and science in fun ways. They just sit there and talk. They should fun it up.
- Teacher writes problems on the board and then calls students up. I think she should give a really hard math problem and whoever gets it right should get a reward.
- Teacher would make it easier by saying it in a different way.
- Help kids with math problems. Teacher could teach and then come back and help other students.
- Teacher would be using learning games.

Middle School Student Comments

- Teacher would be grading papers. The teacher would make sure everybody did something right.
- Do things with the class.
- Let kids teach.

High School Student Comments

- Teacher would be more involved.
- Less teacher talk. Teachers are bored with what they're teaching, add some excitements. Teachers need to be sure everyone understands before they move on.

What would you study or learn about in your ideal math class?

Elementary School Student Comments

- I like geometry, we don't get much of it. I like geometry, decimals, and fractions. I would like to study more on decimals and fractions.

- Study fractions, multiplication, division, and geometry.
- Give math lesson on division. Do something new, new fractions. Study harder fractions, harder multiplication.
- Have math and science together.

Middle School Student Comments

- Learn about a variety of things.
- Combine both math and science. Graphing.
- Teach algebra.

High School Student Comments

- Things should be relevant.
- Make us do different stuff.

What kinds of activities would you be doing in your ideal math class?

Elementary School

- Play a dice game. Play a game so kids get more involved.
- Playing math games. We would have teams go up to the board and score points.
- A spelling bee would be great.

Middle School Student Comments

- Math and science games.
- Playing math games. Competition. Play number games.

High School Student Comments

- More computer work. More games like back in sixth and seventh grade.
- More projects. Free time.

How does your ideal math class differ from what typically happens in your math class?

Elementary School Student Comments

- She does it on the board, and then we talk it out. Teacher writes problem on the board and then calls people up. She's gives out a lot of homework, too much. If our teacher didn't make us write things it would be different, easier.

Middle School Student Comments

- We can't talk in our class now. Now if we chew gum, we get a grade taken off. Not a lot of homework, now we have a lot of work.
- Like how my teacher does it now. She'll explain and then we'll do some problems. My teacher just gives us directions and we do problems. He just assigns bookwork and sits and grades papers. Our teacher's not open-minded. I would like it if we didn't have to write so much.

High School Student Comments

- All we do is just sit there. We skip over things. Not just note taking. Not just worksheets.

Ideal Science Class

If you could describe your ideal science class, what would you be doing?

Elementary School Student Comments

- The teacher should do fun stuff and hands-on activities. Need more fun activities.
- Do a lot of experiments. It would be neat if we had a laboratory to do dissecting. In science we could go out and clean the neighborhood.
- Experiment with things. Have math and science together. Mix chemicals. Change tests used and tell how you know what you know.
- Fly things. Have a remote control airplane.

Middle School Student Comments

- Experiments, better experiments. Volcano experiments. Cutting frogs. Not a lot of homework.
- Do more experiments. Want to dissect things. Watch science movies.

- Design our own experiments. Visit the zoo. Have more long-term assignments in science.
- Doing experiments. Conducting experiments. Go to the zoo or lab. Go somewhere to learn about animals.

High School Student Comments

- More projects. More real-life opportunities. Hands-on. Smaller classes.
- Lots more hands-on. Make it fun, hands-on learning experiences, not just note taking.
- More labs.

What would your teacher be doing in your ideal science class?

Elementary School Student Comments

- The teacher should teach science in fun ways, they just sit talk.
- They would listen to what we tell them.
- Teacher would help gather materials. Teacher would be helping out. Teacher would help us make charts.

Middle School Student Comments

- Teacher would be grading papers.
- Correcting sheets.
- Help us with experiments. Sit and listen. Help us.

High School Student Comments

- Be energetic, explain more. More person to person, one-on-one personal attention.
- Make us do different stuff. Teacher should take notes and have a substitute teach class.

What would you study or learn about in your ideal science class?

Elementary School Student Comments

- Where hot air balloons come from. How the light bulb was invented.
- More about the earth, like how to save things and don't be litterbugs and stuff. Study the sky. Go up in a rocket and study the sky. Study galaxies, the moon, how the craters got there. Study water in the sea, how the water evaporated.
- Trees, because other animals need them. The environment and go to a park. Learn more about the human body and bones. How volcanoes erupt.

Middle School Student Comments

- Chemistry.
- More animals. How earth works. Rainforests. Endangered Species. Plants.
- Reproduction. Sex education. How the body works. The environment.
- Learn about animals. Zoology. Forests. Volcanoes.

High School Student Comments

- No comments.

What kinds of activities would you be doing in your ideal science class?

Elementary School Student Comments

- It would be neat if you could take some colors and put some colors in an egg thing and take an eye dropper. Do a lot of experiments. Do dissecting. More hands-on.
- Fly things. Go to a lake on a field trip.
- Use microscopes. Experimenting and dissecting. Math and science games.
- Go to the park. Watch a movie. Look at microscopes. Actually plant seeds and see how it feels to see how it grows. Make a model volcano, mix stuff to come out.
- Mix chemicals. Experiment with things. Putting things back together.

Middle School Student Comments

- Experiments. Volcano experiments, when you put stuff in it erupts. Cutting frogs. Science games.
- Do more experiments. More activities instead of worksheets. Want to dissect things. Make it fun, experiments like how far can you hit a ball?
- Design own experiments. Visit the zoo. Plant flowers. Go to nursing homes. Have more long-term assignments in science.

High School Student Comments

- More projects. More real-life opportunities. Hands-on.
- More labs. Computer work. More games. Play a game just before a test to review. Take notes on what students say they need to do to learn. Show a short video on how to do something.

How does your ideal science class differ from what typically happens in your science class?

Note: Students did not differentiate between mathematics and science on this question. Refer to question above in the mathematics section for specific responses.

INDIVIDUAL WORK OR GROUP WORK

In math or science class, would you rather work in groups or alone? Why?

The majority of elementary students preferred to work in groups citing that it's more fun, helps give you more ideas, and there's more help available. Approximately one fourth of the students indicated that they preferred to work alone because they can go faster, it's easier to work things out alone, you don't have to help others, and/or it's less confusing.

The majority of middle school students also indicated that they would prefer to work in groups because of the opportunity to share more ideas. About one third of the middle school students said that they preferred to work alone citing that other students often "goof around." A couple students specified that they would like to work alone in mathematics only.

With the exception of a few students, high school students indicated that they prefer working in groups mainly because students can help each other. The few students who indicated that they prefer to work alone felt it went quicker especially in certain subjects like biology.

Elementary School Student Comments

- Groups, if someone doesn't know a problem, someone else can help but not tell the answer. There isn't just one idea, there's a bunch of ideas and different work types. If you don't know then someone else can help you.
- Alone. I like to think things out by myself.
- Alone, it's easier for me, I don't have to help so many. Alone, I can go faster and not have to wait for anyone, just use your brains. Alone, less confusion.
- Groups, it's like having your own little answer box. It's harder learning on your own. Groups, if you don't know something someone will help you.

Middle School Student Comments

- Groups, in groups you get more brains. You learn to work together, more brains.
- Groups, because you can share work. Learn others opinions. Get help. Get to know others.
- Alone, think more, others disturb me. Alone, others goof around and make me goof around. Alone, others goof around and then copy off you.

High School Student Comments

- Groups, students can help other students understand better. Boost each other up.
- Groups, it's always better. In geometry it helps kids understand quicker. Groups for geometry you can compare answers. Science we work in groups, we help those that need help, help the teacher out so he won't be so long on our lesson. Alone in biology, it goes quicker, you get more done with the lab and stuff.

WHY STUDY MATH AND SCIENCE

A lot of kids wonder why they have to study math and science in school. How will it help you with anything outside of school? Can you give me some examples?

The majority of elementary students saw the practical need for mathematics instruction primarily for daily life skills rather than job skills. For example, most students thought mathematics would help them manage their money for purchasing things such as food or for paying bills and taxes. Some students did mention the importance of mathematics for certain professions such as a teacher, doctor, scientist, or architect. Overall, students had more difficulty expressing the value of science education. Many of the science responses reflected the importance of health and safety issues. Rarely did elementary students relate their mathematics and science education to their current lives.

Middle school students also saw the practical need for mathematics instruction for daily life skills, but almost just as many mentioned "jobs" or specific careers in response to this question. The daily life skills mentioned were mostly centered around spending money for the purposes of paying bills, taxes, and purchasing everyday items. Specific careers mentioned included teacher, doctor, lawyer, and engineer. A few students conveyed the importance of science and how it effects our environment. One student indicated that he felt there was no use for science.

The majority of high school students indicated that mathematics was important for daily life skills and mentioned paying taxes, using money, balancing your checkbook, and estimating as reasons to learn mathematics in school. A couple students mentioned the importance of mathematics for helping them with their thinking skills and making them better problem-solvers. High school students appeared to have a difficult time seeing the practical importance of science in their everyday lives.

Elementary School Student Comments

- When you go to the store, if you don't know math, you may get wrong change. When you go to the bank. When you buy something like ice cream at the beach. Science is helpful if you work at a scientist job like with fossils, digging coal, or other science jobs. Science helps if you work at a museum to answer visiting class questions.
- It will help you when you're grown up and you're a teacher. It will help with your job. For your budget, it is helpful for you to know how much you can spend. It will help when you're paying bills.
- Math will help you when you go to the store and buy something; you can make sure you get the right change back. You use math all the time. Science is helpful for your body in case something happens you know what is it. Science is helpful so you know which animals are poisonous.
- Shopping. Change. Taxes. Rent. Fix house. Health.
- In order to get good jobs, math is one of their highest standards. Get jobs in the world. If you want to be an architect you're going to have to know how to measure.

Middle School Student Comments

- Get jobs. Jobs. Grocery store, taxes. Taxes. Need for every day life. Science for work and home.
- How to handle money and not be cheated. Math careers need math. Medical science career you need both. Be a doctor or lawyer. Medical field. Know about the environment and what to do to save it.
- If you don't know how to count you'll get cheated.

High School Student Comments

- Taxes. Using money. Measurement. Estimating. On a job using some skills. Makes you do problem solving.
- Working in grocery stores you need to know math. Balance your checkbook. Science isn't used everywhere like math.
- Helps with your career. Better thinking processes. Some of the stuff I know I am not going to use.

MATERIALS, TOOLS, AND TECHNOLOGY

What kinds of special things-things like counters , containers, tools, toys, equipment, and machines-do you use in your math and science classes? What do you use them for?

Do you ever use calculators or computers in math or science class? How often do you get to use them? What do you use them for?

According to elementary school students, the most frequently used classroom materials and equipment are tools for measurement such as rulers, beakers, compasses, and scales. Students rarely elaborated on why they used this special equipment, but the types of tools most frequently mentioned were usually associated with science class. A few students did mention types of manipulatives which they apparently used in their math classes.

When elementary students were asked about the use of computers and calculators in mathematics or science class, the majority indicated that they use computers mostly for math games and used calculators to check their work. Very few students mentioned using computers or calculators for science purposes.

According to middle school students, the most frequently used classroom materials and equipment were those for measurement such as rulers, compasses, protractors, and scales. Almost every group mentioned calculators, but overall, most of the materials mentioned were related to science. Many students mentioned science materials that they related to specific science projects.

When middle school students were asked about the use of computers and calculators in mathematics or science class, the majority of the students indicated that they use computers for math games and sometimes word processing. Calculators were mostly associated with mathematics class.

High school students mentioned both mathematics and science tools equally when asked about the most frequently used materials and equipment used in their classes. Some examples of mathematics tools included Legos, rulers, protractors, compasses, and calculators. The science tools mentioned included dissecting equipment (scalpel, pins, and scissors), Bunsen burners, cylinders, and microscopes.

When asked about the use of computers and calculators in classes, high school students indicated that they used calculators for mathematics almost every day. Whereas computers were used infrequently for mathematics or science.

Elementary School Student Comments

- We use rulers, so you can measure what you need and calculators because sometimes you have problems you need calculators for and we use beakers to like measure stuff, and we also use scissors, and graduated cylinders. In math we use rulers, calculators, and markers. In science we use beakers, graduated cylinders, and different liquids.
- With math and computers there are a lot of different games that we play on there but mostly we don't use them in our class. We usually don't use the computers, we use calculators. We use the computers when in math, we usually use them like to practice our math with them and we get better at it.
- We use different shapes for geometry. Calculators, protractors. Rulers, compasses. In science, we use beakers, test tubes. Those hot plates, stop watches, magnifying glasses.
- We really don't have computers in our classroom so we don't use them but we use calculators. Our class doesn't use calculators that much because our teacher thinks we can get it on our own.
- We use calculators when the answer is hard. We check our math homework with calculators. We don't use computers that often. Play "Troggle Trouble" for math, but not that often. We play "Math Blaster."
- Some tools we use are scales, magnets, thermometers, Legos, containers, science boards, and calculators. We use calculators for hard problems. Use calculators for hard multiplication. We use computers for math games and to solve problems.
- For science we use microscopes. Electrical stuff. For math we use counters and blocks. Sometimes we do math on computers on our own time. We sometimes use calculators.

Middle School Student Comments

- In science we use scales, beakers, and levers. We use calculators sometimes in math. We use computers in science for reports.
- We use calculators, rulers, compasses, protractors, books, Bunsen burners, beakers, safety glasses, chemicals, lots of stuff. We use calculators often. We only use computers to play computer games. We use computers to do science research three times every three months.

- In science we use test tubes, microscopes. In math we use protractors and rulers and calculators. We don't really use calculators or computers for science, sometimes we use them for adding up like averages and stuff. We use word processing a lot if we have any papers for science.
- In math we use shapes, rulers, and calculators. In science we use scales, calculators, graduated cylinders, and beakers. We hardly ever use calculators in math and not too often in science. We use computers for word processing, internet, and CD-ROM.
- We use calculators in math sometimes, but for computers, we just get to take keyboarding class.

High School Student Comments

- We use rulers, protractors. We should not use "tools," we should use our head, brain. We use calculators every day for making graphs, we don't use computers.
- For math we use TI-82s. In science we use scalpel and scissors, pins, the dissection trays, Bunsen burners. We used one machine the first semester, it like separates DNA because we're trying to take DNA out of duck blood. So we used this weird little machine.
- We use calculators everyday. The drawer is open and as soon as you go in there, just grab a calculator and sit down.

WHO HELPS YOU

Sometimes people find math or science difficult. How about you? What do you do when you are trying to learn some math or science that is hard? Does anyone at school or at home ever help you with your math or science? Who helps you?

When elementary students have difficulty with their mathematics or science work, they most frequently turned to a family member for help. Students said their parents helped them with mothers being mentioned twice as often as fathers. In addition, many students asked their siblings and extended family members for help, depending on who was available. The students also asked teachers, friends, and sometimes relied on their own problem-solving skills, but these responses occurred with less frequency.

Similar to elementary students, middle school students most frequently relied on their family members for help with their mathematics and science work. Twice as many mothers were mentioned as fathers and siblings were also mentioned but with less frequency. Surprisingly, when students were asked what they do when mathematics or science is difficult for them, many mentioned that they asked a teacher, but when asked who they go to for help, teachers were not mentioned.

When high school students have difficulty with their mathematics and science work, they turn to a variety of sources for help. Teachers and parents were mentioned equally, but students also mentioned that they asked other students, go to the computer lab..or look in their book for additional help for explanations.

Elementary School Student Comments

- With math I mostly go to my mother, because she likes math, and with science I go to my dad because he is a chemist and he does a lot of things with science.
- If I need help I go to my mother but most of the time I tell my teachers if I don't understand it for them to explain it more before I go home.
- My mother. She like gets home late at night and then I will just lay my homework on the table and she will wait until the morning or wake me up at night when she gets home and then she will go over the problem with me and help me.
- I have like three older brothers but I have two that will help me if I just ask them and my parents will help me if I ask them.
- I just think about it in my head.
- I estimate or use a calculator. My mama doesn't give me the answers but she shows me how. I have a computer at home. I keep trying or ask my mom or sister. I ask my mother she shows me how.
- My sister and mom help me when something is hard. My uncle helps me look up topics. My mom and grandma help. My teacher helps and encourages us. My mom and cousin and teacher help.

- My mom won't give answers, she makes me do the work. I go home and practice. I look in the index, I look up when I forget. I ask for help from my mom or dad. At school I ask teachers or another student.

Middle School Student Comments

- I ask the teacher for help. I ask other students. I ask the student teacher. At home I ask my mom or brothers. I ask my parents or brother and sisters.
- At school I just try. I usually ask the teacher and then as soon as I catch on I can do it like that. I try to figure it out and if I can't I ask the teacher. At home I ask my dad. I ask my older brother.
- I ask questions. I ask the teacher and student for help and take notes. I get help at home from parents and sisters.
- I ask my sisters and mom. My mom. My 15 year old sister. My dad when I visit him on the weekends.
- I ask my mother, her boyfriend, anybody. I ask my uncle because he's a math teacher.

High School Student Comments

- No one helps me with math and science work.
- On the computer for math, you go to surgical student and you go down to hint and you keep hitting it , and if you still don't get it after like fifteen times, it will actually give you the answer.
- I ask students who are good. I go to the computer center. When it's hard for me I get a headache.
- In math we ask the teacher. With the math, you usually ask the teacher, but for science, you usually go in your book and read back about the thing, and it helps, if not then you ask the teacher. We can read back in our books, and I do that sometimes, but usually all you have to do is ask, like in math, just ask and he'll explain.

STUDENT PERCEPTIONS OF TEACHERS' ATTITUDES

Do you think your teachers like math or science? How can you tell?

The majority of elementary students interviewed perceived their teachers as liking mathematics and science. The reasons students gave were varied. Many felt that the amount of time the teachers spent teaching these subjects along with their facial expressions and body language indicated their teachers enjoyed teaching these subjects. Some students also made the assumption that since their teachers chose to be teachers they must love math and science. Science teachers were more positively perceived than mathematics teachers.

Middle school students perceived their teachers as liking mathematics and science for the most part, however, a few indicated that they believed their teachers did not like these subjects. Students mentioned that their teachers' positive moods and the fact that they spent so much time teaching these subjects must mean they like mathematics and science. In addition, middle school students also assumed that since teachers chose this profession, they must like mathematics and science. In contrast, a few students mentioned that they knew their teacher didn't like mathematics and science evidenced by the teacher's negative mood and behavior while teaching these subjects.

Most of the high school students interviewed perceived their teachers as liking mathematics and science. The reasons given were limited. One student felt his teacher didn't like math and science because the teacher seem disinterested in it.

Elementary School Student Comments

- I think I know my teacher likes math by the way her face just starts glowing if we get the answer right. And I think Ms. "X" likes science because of the way she smiles when we get an answer right or if we are getting ready to do a project she starts rubbing her hands together and starts smiling so I think they like the subjects they teach.
- In science I think my teacher is very into it because she goes to great lengths to get us what we need to have science.
- I think my teacher is interested in science because she tries to give us a lot of things to do that is about science and she makes science fun.
- I think I know our math teacher likes math because she always teaches it to us. I think my teacher likes math because she likes to spend a lot of time with us on it. My teacher gets really excited when the science

fair comes up, she gets really happy. I think my teacher likes science because she is always giving us these fun projects and always talking about science.

- Our teachers like it because they always want us to do it. She's got a whole bunch of science stuff, and every time we finish our work, she'll help us do an experiment or something. She always has a smile on her face. They do it every day.
- Our teacher likes math. She finds "cool" ways to teach. Our teacher likes science because he likes "Star Trek." Our teacher likes science because we're always doing science, and we also do a lot of math.
- I think she thinks it's okay because of how she teaches it. With math, if she wants to be a teacher she has to like it. Yes, she likes it because my teacher takes a long time to explain one problem. Yes, I can tell my teacher likes it by her expressions. My math teacher, yes, because she has a great smile. My teacher must like science because when the science teacher comes in our teacher always adds to the science lesson.

Middle School Student Comments

- Our teachers like math and science because they get real involved, they help us and they want us to get it.
- Yes, our teachers like it because they always look happy. They went to college to do it. Yes, because they are always talking.
- Yes, our science teacher is really into it because that is all they talk about. Our math teacher doesn't like it because she makes us copy notes off the board.
- No, my teacher doesn't like math, she told us. My math teacher is always screaming at us, she can't like it. If she didn't like it she wouldn't be doing it.

High School Student Comments

- Many teachers do seem to love it and are motivated. The younger ones are easier to approach. Yes, they must like it, but our teacher doesn't responded to us.
- Yes, some of them like it, but some of them convey disinterest. They need to be eager and appear to like it.
- Yes, they know their stuff and really like it.

OTHER STUDENT COMMENTS AND QUESTIONS

Is there anything else you'd like to tell us about your math or science classes?

Elementary School Student Comments

- One last thing, math is sometimes fun and science to me is always fun because you get to explore things you never explored before.
- Well, I'm not trying to be critical or anything but I want the time to go shorter in science because it's kind of dull, nothing really excites us. Its like well blah, blah, blah, blah, blah.
- Math is sometimes fun, sometimes hard. Math projects can be fun, but if the teacher doesn't like math, it can be boring. Teachers push you so you learn. Teachers want you to do your best, to help with careers.
- I got some glasses from science that are 3-D. You can see rainbows. I'm learning about colors. Now weather.
- I like class because we don't use books, we use things I like and I think more.

Middle School Student Comments

- Math is boring. Teacher explains and writes on board, doesn't check up to see if we get it. It isn't clear about what is expected. Boring.
- I want a new teacher because the one we have she always yells at us.
- We have videos in science. I don't like the videos because it seems like they don't explain it well or I just can't follow it. I have to have a person explain it to me.

High School Student Comments

- Make or let students develop a good attitude. It's a lot more complicated. More technology and computers. Need light in the rooms, especially windows. Need to talk to students who are not doing well.
- The teacher complains a lot. They also imply that you should know this. The answers are in the back of the book.
- I just wanted to say that it's fun. I mean I'm happy on taking those two classes. I mean especially since I'm only a freshman and I am already taking sophomore classes, so I'm happy about that, and then my senior year, I'll be able to go to a college campus for my classes so I'm happy about that.
- With the PUMP program, they should keep it here for awhile because it helps. Like for us, we have a second chance, but maybe the people that go here next year, they'll get it the first time and not have problems with the credits.

Is there anything you would like to ask us?

Elementary School Student Questions
- Do you like science and math?
- What do you teach?

Middle School Student Questions
- Why are we doing this?

High School Student Questions
- What is the purpose of this? Why did you pick us?
- Why do we need tests?
- Why are you interviewing us?

SUMMARY

Students from First Wave MUSI schools participated in conversations on learning mathematics and science. Eighteen groups of students were interviewed . Each group consisted of five to six students for a total of 93 students. Forty-seven students were from elementary schools, 29 students from middle schools, and 17 students were from high schools.

This chapter presented each interview question with a summary of the responses and a selection of illustrative student comments. The following is a list of views that emerged from the conversations with students.

Math and Science Class

- About half of the elementary school students commented that they like math or found it easy. The other half of the students described mathematics as boring, time consuming, or hard. Very few students described mathematics as a hands-on learning experience.
- The middle school students described mathematics as good, okay, difficult, crazy, kind of hard, and boring.
- About half of the high school students like math and found it interesting. Some even described it as their best subject. The other students described math as too hard, boring, and a subject they did not like.
- At the elementary school level, all student comments were more positive about science than about mathematics. Several students commented that science was cool, fun, or exciting. They said it was fun because they get to explore things.
- About half of the middle school students indicated that they liked science. Other students through science was boring or too hard. Those with a negative attitude often indicated they did not like how the science class was taught.
- The majority of high school students indicated that they liked science. Many students described specific experiments or projects with which they had been engaged.

Ideal Math and Science Class

- Elementary school students want more teachers to use more creative techniques in teaching mathematics and science. They said they would like more charts, boardwork, examples of why math is useful, and more science experiments. They would also like to see students be allowed to teach some of the lessons.
- Middle school students want their teachers to not lecture or just not talk as much, but rather wanted the teacher to listen more, do activities with the class, or let students teach each other. Specific techniques suggested by these students included guest speakers, more group work, and more games.

- High school students want more hands-on activities, projects, labs, and they want to use the computers more.

Individual Work or Group Work

- The majority of elementary school students said they liked to work in groups because it is more fun and it gives you more ideas. About one-fourth of the students said they liked to work alone because they can go faster, it is easier, it is less confusing, and they don't have to help others.
- About two-thirds of the middle school students commented that they liked to work in groups because they have more of an opportunity to share ideas. About one-third of the students said they liked to work alone because sometimes the other students goofed around too much.
- Most of the high school students indicated that they liked to work in groups because the students can help each other. The few who indicated they liked to work along felt they got their work done more quickly.

Why Study Math and Science

- Most elementary students saw the practical need for mathematics to be used for daily life skills and for jobs. They felt mathematics would help them manage their money and pay taxes. In comparison, many students had difficulty seeing the value of science. Some students mentioned health and safety issues when thinking about science.
- Daily life skills were mentioned by most of the middle school students as the value for learning mathematics. They also saw mathematics as applicable to careers such as a doctor, lawyer, and teacher. As with the elementary students, not many middle school students could explain the value in learning science outside of some issues related to the environment.
- High school students explained that mathematics was important for daily life skills such as paying taxes, using money, and balancing checkbooks. A couple students mentioned that mathematics helped them with problem solving skills. Most high school students were unable to clearly express the value of learning science for their daily lives.

Materials, Tools, and Technology

- Elementary school students readily described the science equipment they used in their classrooms such as beakers, graduated cylinders, rulers, and scales. Some students described the use of manipulatives and calculators for mathematics.
- The middle school students stated that they used tools such as rulers, compasses, scales, and computers for science. For mathematics they used calculators and computers.
- For mathematics, high school students use calculators, Legos, rulers, protractors, rulers, compasses, and calculators. For science, they used scalpels, pins, Bunsen burners, cylinders, and microscopes.

Who Helps You

- Elementary school students turn to a family member most often when they need help with mathematics or science. Mothers were mentioned twice as often as fathers. They also ask siblings, teachers, and friends. Some also stated that they try to solve the problem independently.
- Middle school students also turn most frequently to their family members. Mothers were mentioned more than fathers and teachers were also mentioned.
- High school students use a variety of sources for assistance. They explained that they turn to parents, teachers, other students, computer, and textbooks for help.

Student Perceptions of Teachers' Attitudes

- Most elementary school students assumed that since their teachers chose their profession, they must like mathematics and science. Several also commented that they could tell by their teachers' facial expressions or body language that they enjoyed teaching mathematics and science. These students, however, did perceive their teachers as liking science more than mathematics.
- The middle school students thought their teachers liked teaching mathematics and science since they spend so much time teaching it. They also assumed that they must like these subjects because they choose to become teachers. However, a few students commented that they could tell by their teachers' negative mood that they did not like teaching mathematics or science.
- The high school students perceived their teachers as liking mathematics and science.

CHAPTER 3

CONVERSATIONS WITH TEACHERS

Two groups of teachers were scheduled to be interviewed during each of the site visits to first wave MUSI schools. Thirty-five groups of teachers participated in the conversations for a total of 92 teachers. One group interview was canceled due to unexpected conflicts. The teachers represented a range of grade levels and discussed both mathematics and science. Of the 92 teachers, 50 were elementary school teachers, 24 were middle school teachers, and 18 were high school teachers. Thirty-three percent of the teachers were male and 67 percent were female. Twenty-one percent of the teachers were African American, nine percent were Hispanic, sixty-seven teachers were Caucasian, and three percent were of other race/ethnicity.

Each conversation with the teachers lasted for about 30 to 45 minutes. One site visit team member facilitated each conversation while another took extensive notes. The conversations were also audio taped. The tapes were used to clarify and expand on the written notes. The interview questions are stated below. A summary of responses is given for each question, followed by a listing of representative teacher comments.

MATHEMATICS AND SCIENCE LESSONS

Briefly describe the most exciting mathematics or science lesson that you taught this year.

The most exciting lessons that teachers described usually involved "hands on" experiences. The teachers reported that students at all levels were excited to use equipment, whether it was science equipment or mathematics manipulatives. If the lessons were related to something from the "real world," the teachers also reported that students showed greater enthusiasm and interest. Another element that the teachers observed as adding success to these hands-on lessons was having the students work in groups to help each other and for the groups to work primarily as self-directed groups discovering solutions and concepts.

Elementary School Teacher Comments

- I actually showed them how to make ice cream and they thought that was just wonderful because they could actually eat something they made in science because we are always telling them not to taste anything.
- We made instruments and discovered that different materials made different sounds. Then we displayed them in the school's science fair and everyone had fun playing with them. Then we used those instruments to put on a program to entertain the neighborhood as well as our own school children.
- In my class, we see "Bill Nye the Science Guy" once or twice a week.
- I used "Shake and Spill" from the MUSI class which deals with predictions, probability, and graphing. The students loved it!
- One of the things they enjoy doing is pretending they had a hundred dollars and they had to buy at least five products. They got to look in catalogues and cut out pictures of toys or whatever they wanted to purchase.
- We were doing graphing and studying Garret Morgan, the inventor of the stop light. We went out to the playground and graphed the traffic on the street.
- We used baseball statistics when we were learning how to read decimals. Then we went to the newspapers and read off basketball shooting percentages in decimal form.

Middle School Teacher Comments

- The most exciting lesson was working with converting fractions and learning how to convert recipes—double, triple, quadruple. We are going to bake cookies and they can't wait to do that.

- The kids and I had the most fun with probability using two cups, two orange cubes, and two blue cubes.
- I taught a twelve week unit on different environmental studies. One of the things we did was decomposition columns. I have noticed that the hands-on stuff I do works like a charm and the kids get so much more out of it when I do stuff like that.
- My lesson was dissecting deer hearts. This was a four day lab using microscopes. Students went from knowing nothing to being able to do just about everything.

High School Teacher Comments

- My integrated science class worked on gathering data for our weather station. We graphed our data and compared it to radio station announcements. From that, the kids were able to determine what factors may cause errors.
- My favorite is a DNA experiment that we do. Usually at the end of the semester that always comes up as one of their favorite activities.
- We just completed a unit in our geometry class. We used T-82 calculators extensively. The students thought is was difficult at first, but as we went along they found it wasn't as difficult as it looks. And they had fun.

STANDARDS-BASED TEACHING

Would you characterize your mathematics or science teaching as standards based?

Some teachers described how their mathematics or science teaching was aligned with national and local standards, such as the National Council of Teachers of Mathematics standards, MPS standards, or school developed standards. Whereas other teachers indicated that they were not familiar with any of these standards. It was noteworthy that the range of the answers illustrated confusion and contradictions among teachers within the same school.

The teachers indicating their teaching was standards-based explained how they used benchmarks to assess learning as well as set their own goals for their students. Teachers suggesting their teaching was not standards based remarked that they were unclear about the meaning of the term "standards," were unfamiliar with the standards within these disciplines, or did not have enough time or support to meet the standards.

Elementary School Teacher Comments

- Yes, we have standards and benchmarks that we meet for each grade level.
- I couldn't say whether or not I have any real evaluating tool.
- It's overwhelming in science. Too many things coming from too many sources.
- We meet the district standards then we also have our own tests and assessments.
- I would say I am at the developmental stage. I don't think a lot of people really know what all these standards are about.
- I would characterize mine as standard-based because I'm following the mathbook and I'm doing most of the activities within the book but there are times when I do activities above and beyond to make it a little more exciting for the children.
- I follow the mathbook but with the kids that we have today it cannot be just the skill and drill. They get very bored and there has to be more action involved. You have to incorporate games. You have to incorporate manipulatives. You have to get them moving around because otherwise your going to loose them.
- As far as science, we get science kits so I use those and we have science units. I do devote at least 45 minutes, or try to, of my day to science.
- I am not familiar with standards-based, but Milwaukee Public Schools has a motto that's posted on its buildings that says "High Standards Start Here." So I feel that I'm justified in demanding that kids get their work done and that they do a neat job of it and that if it's not done properly that they make the effort to fix it up with my help whenever possible.
- I also am not familiar with the words standards other than what I can think of as DPI. I follow the district curriculum and I work through the science and the math that they have set up for me but I don't know the term standards.

Middle School Teacher Comments

- New teachers use them 100 percent of the time and other teachers use them 80 percent of the time because they are improvising.
- Yes, NCTM standard are used as well as our own testing.
- Yes, I've learned a lot of them from our MSRT.
- No, there are too many time constraints.
- I think we are moving in the right direction. We are teaching what they need to learn for high school and college. I just wish we had more time to go in depth.
- Standards-based. I don't know what that means so I guess I would not characterize mine as that.
- I would say somewhat yes and somewhat no. I rarely use the textbook at all that we have or I'll mix and match the textbooks. know. I'll be teaching sixth grade kids, but I will use what is supposed to be the eighth grade book if it matches with what I'm doing. I'm trying to teach more like inquiry things. So I guess, it might be standards-based.
- I teach according to the MPS benchmarks and I am aware of the NCTM standards too. I try to use the problems and try to use real life situations so I think my teaching is between the two, but I tend to lean my curriculum more toward the benchmarks.

High School Teacher Comments

- Yes, I am very active in MPS and NCTM standards.
- Each teacher has his/her own goals as well the district's.
- We try very very hard to fulfill, but I think it has become very very difficult for the teachers. There are a lot of demands on the teachers and not enough support. I feel like even though some of these activities are exciting for the students and very time consuming for the teachers, it does take a lot on the part of the teacher. Sometimes I don't think other people realize how much the teacher has to do. We try, we really try to go with some of the standards.
- Well, I think every teacher has their own goals and objectives and they have to look at district objectives as well as things that they would like to see their students prepared for later.
- In biology, there's basically a core set of knowledge and activities and thought processes that we try to get the students at least exposed to depending on which topic.

NEEDED RESOURCES

What do you feel is the most important resource needed in order to make a significant change in improving your students' learning of mathematics or science?

Time was the resource the teachers indicated as most needed in order to make a significant change in impairing their students' learning of mathematics and science. Planning time was mentioned overwhelmingly, as was the desire for more time to collaborate with and learn from colleagues.

The next largest concern was class size. Teachers pointed to classroom management problems and the inability to reach those who needed one-on-one assistance as a result of the large numbers of students in their classes.

Another resource cited was materials. The teachers voiced overwhelming concerns about lack of materials to do science and mathematics projects. Comments included not having broken items replaced, not having enough technological support, and not having textbooks for the children to use in class or to take home for study purposes.

Other resources that were mentioned included the need for a support person such as the MSRT and more staff development. The teachers greatly appreciated having MSRTs to support them and remarked that it would be beneficial to have the MSRTs or a similar person full-time in their schools.

Elementary School Teacher Comments

- I team-teach with another teacher and that's something that I wish we could have a little more time to plan. Lots of times we do it quick on our lunch hour.

- It's very difficult working with manipulatives and games and the action kinds of activities they so desperately need when you have only one person in the classroom.
- Our MSRT is excellent. I mean she is a phenomenon.
- The mentoring we receive from our MSRT in the building is most valuable. We are able to watch others modeling science lessons.
- We need more enrichment and support for classroom teachers.
- I find it hard to know how to integrate manipulatives and all of the things I was taught in school. Staff development would help.

Middle School Teacher Comments

- I would like more time to see what other teachers are doing and how they bring in other activities.
- I would say smaller class sizes. Right now I have 33 to 35 students in class. When students have difficulty, it's hard to spend one-on-one time.
- We can't do some of these projects with 32 kids, maybe with 10 to 15, but not with 32. Getting the materials to do projects with 32 kids is sometimes hard.
- We need more funds to replace materials that are broken.
- We need computers, calculators, and things that go beyond the curriculum.
- Our MSRT has given many ideas and follows up with us.
- We need a full time person to help with math and science for team-teaching and hands-on activities.

High School Teacher Comments

- I think it's time. There's more knowledge coming along. Along with that open-ended labs make it hard to find time to rewrite and redo new activities that move into a general education plan.
- We need textbooks. There are no textbooks for the kids.
- Each child needs to have their own textbook to take home.

TECHNOLOGY

Describe how your students use technology, such as calculators and computers, for learning mathematics and science. What other technologies do they use?

Most of the teachers provided opportunities for students to use technology in some form for learning mathematics and science. Calculators were used by students at all grade levels, particularly at the middle and high school levels. Computers were used much less frequently than calculators. Some teachers commented that computers were difficult to access.

Elementary School Teacher Comments

- We use computers in first grade regularly, including the Internet for the "Journey North" project.
- Teachers often send kids to the computer lab to use the Internet.
- I use computers in my room daily to teach fractions and use calculators to teach decimals.
- As far as the calculator goes, I go to the office once or twice a year to get the calculators to give them opportunities to learn to use them correctly.
- We use our computers every day. Calculators we don't use daily, but we do take them out to start solving the hard problems.
- We use a calculator to check many of our math problems. We use a calculators to do some fun activities that also correlate with their math. We use the computer as reinforcement for basic math skills.
- We have a lot of kids that don't have any kind of idea how to work on the calculators.
- Perhaps it's a resource we need to use more, because I do teach from the text. There isn't a lot of calculator use in the text. There's a few pages, but not a lot.
- I use the calculators a lot. I really don't have access to computers. I have one computer in my room but it isn't an Apple, it's an IBM and its only got games on it. It doesn't even have a word processing unit on it.
- We don't use calculators. We don't have any for first grade.
- One of the things that I want to do is learn how to use the Quicktake camera that we have in the building. I just found out that we had it all year. I want to use it when we are doing a science lesson or out on science field trips. The children can begin to put together what's happening on these trips and integrate it with writing and speaking and thinking, and then create a computer visual with it. I think that'll be real exciting and something that creates a lot of buy in by the kids, a lot of ownership.

Middle School Teacher Comments

- We use CD-ROMs for research and will be getting graphing calculators.
- We use computers for reinforcement about eight times a year.
- We use computers for science units and calculators for math. By the end of the year each room will have a computer.
- We use the computer lab to do graphing, calculating, spreadsheets, and some dimensional drawings.
- Our resources are outdated, but we do use computers and calculators.
- We don't use calculators or computers in my room.
- I don't have calculators in my classroom or a computer. We go to a computer lab twice a week and they do have a math program that they do up there but nothing with science at all and we don't do math every time we go up there.
- The students use calculators every once in a while but I tend to shy away from that because I guess I am from the old school. I like to be able to see the concept you know how everything goes together first and then use calculators later.
- I am pretty lucky because I am right next door to a computer lab and I can get in there almost every other day.
- In my classroom, I have seen that students are very excited when they are encouraged to use computers to do their research and to report it. They try to do a brochure, more like a professional final work. It seems to build pride in their work.
- All my students have access to scientific calculators and explorer calculators and some days we use them and some days I say we are not going to use them because I don't want them to be dependent on them.
- My eighth grade class is starting to use graphing calculators but we can't find our overhead graphing calculator which makes it very difficult to enter key sequences without having being able to say your screen should look like this.

High School Teacher Comments

- My students work on computers two to three times per week on reading science materials.
- In biology, I did a DNA duckwood experiment that involved biotechnology.
- We use mostly calculators. We don't have much access to the computer labs.
- We work with the graphing calculators. We're trying to figure out how we can integrate the math and the science where we have some skills in common we can work with.
- I have got my students going to the Internet to look for materials. That has also helped in the sense that some of the materials you were able to translate per the computer, it does it by itself. You can request a certain topic and say, hey, I want it in this language, and you can get it for yourself.
- We used computer technology to work on their family tree and do the research on the various diseases.

ASSESSMENT STRATEGIES

What kinds of assessment strategies do you use in your classrooms?

Middle and high school teachers reported relying more on written testing as a method to assess their student's learning than did elementary teachers. However, they did add that especially in science classes, a great portion of the assessment is based on performance. For elementary schools, performance assessment was mentioned most often with observation of daily activities close behind. Overall, the teachers described a variety of assessment strategies that they used to gauge student learning.

Elementary School Teacher Comments

- We do portfolios as an ongoing assessment tool.
- We do journaling in math and science.
- I call them to the board and have them explain (a problem) step-by-step. Then I know a child really understands.
- Fourth grade performance assessment was incredibly frustrating for the children because they didn't know how to deal with what they were trying to do.
- We had "dismal" performance assessments.
- I have them write after every science activity.

- I like to use the overhead projector and the students come up to the overhead projector and I'll ask them to do a problem and explain it so that they're the teacher and I can tell from that with the other assessments how they are doing.
- I don't give tests in science because I really don't think that's necessary. Where I assess is if they are able to put what it is we just learned into their own experiment, for example with the scientific method.
- For math it's daily work and testing.
- For science I do a KWL and when they fill out the "learn" part, I kind of figure out what they've learn from there.
- My assessments in math are who answers in class and how they answer and I check the assignments that I give.
- I haven't really concluded how the assessment should be done in science. I'm not real sure about that because I've been introduced to the process of science according to the district curriculum and it's a complex curriculum and it's different from science curriculum in the past. I've always been an observer of kids so I've observed while they are working and I've also given some pencil and paper tests about what they've done.

Middle School Teacher Comments

- After I have presented a concept (in math) I have a couple of students teach a lesson using the overhead.
- I have the kids teach ten to fifteen minutes at the board.
- We have a math proficiency test for seventh and eighth grade.
- We are also developing a pretest and posttest for science.
- I haven't really concluded how the assessment in science should be done.
- My kids keep a portfolio.
- We give a diagnostic test at the beginning and end of the year.
- I use different varieties of, I guess, your regular standard true-false, tests, and quizzes.
- With the math proficiency, this year for the first time it looks like we are going to be able to actually get them back and use them with the kids to get them used to communicating their answers in the written form better and documenting their work better, not just putting down an answer.

High School Teacher Comments

- Outside of the normal tests and quizzes, we use essay questions, concept mapping, direct observation, and experiments.
- I use a lot of worksheets with my algebra kids. We feel that they need more practice so we run off worksheet after worksheet because the kids need the practice.
- In the science department, we feel that it would be unfair to our students to only give them one kind of a type of assessment, so we try to mix it up. We do the regular kind of test, you know, multiple choice. But they also do other kinds. They do performance assessments and projects.
- Well, outside of your normal test and quizzes, there are some essay problems and some open-ended things that we try to work in.
- I also do both informal and formal performance assessment, adding more formal performance now that we got a new one coming in. I do very little written tests. If we have one written test in six weeks that's about it, and often I'll let them use a note card or something just so they've done a little extra studying and prepare that card.

PERFORMANCE GAP

What efforts are being taken in your school to address the performance gap between white students and minorities in math and science?

Many teachers commented that they were not aware of any specific efforts to address the performance gap within their schools. Some elementary and middle school teachers described efforts to address the performance gap by having students work in groups, by using diverse teaching strategies, and by making use of the MSRT for advice and guidance. The high school teachers expressed a sense of frustration in trying to address performance gaps.

Elementary School Teacher Comments

- We use attendance incentives and it did improve attendance of those who usually don't come.
- We divide the class in two to allow use of more manipulatives and see who needs help.

- MSRT works with older students hoping to narrow the gap.
- Our MSRT helped to evaluate levels and target weaknesses.
- I see no color, just students.
- It's difficult. We are floundering.
- We are trying to develop the self-esteem, the self-consciousness, the heritage, and background so having the students being able to identify the fact that Africans and African Americans have been well known in the science and math fields. Then there is no reason why they themselves can't excel and participate fully in those subject areas.
- I think as individual teachers, we can become paralyzed by those numbers. We need to just identify what we want to accomplish, get out there, do it, and have the students succeed. I personally do not worry about the gap.
- Another intervention I used to help in relationship to the performance gap was flexible grouping and bringing children together with particular skills to be worked on over a period of time and then disbanding that group rather than keeping kids in locked groups. So I use flexible grouping and that's part of the way I address that.
- I don't know that we have a specific program tailored, but I think we try to teach everyone equally. I think that what comes out as a result and who has the greatest needs is who you go to. As a good teacher, most of the time you see the students that need the most help. So, I can't say that anything is "custom tailored" in this building to changing the "gaps."

Middle School Teacher Comments

- I have made home visits to parents to discuss academic and discipline matters.
- At our school, math teachers meet weekly and science teachers meet with the MSRT.
- We all use a variety of teaching techniques instead of the old way of teaching.
- We use Title I funds to tutor slower students.
- Our MSRT helped to evaluate groups and target weaknesses.
- In our school educational plan, science was chosen as one of the things to deal with gender and race gaps. The thing that we talked about that would be easy to assess is participation in the science fair and in that there's going to be more female and more non-white kids successfully participating in the science fair.
- I have heard it at numerous math inservices and at meetings and Equity 2000, you know about closing the gap, but it really hasn't been addressed here at our school at a staff meeting or math meeting or anything that I know of.
- I have the feeling that we are just trying to get everyone up regardless of color and ethnic background.
- I think we can a do a lot more with smaller class sizes. I mean I keep coming back to that but I think it's a big thing. We had a couple classes earlier in the year that had 16-17 kids in the class and those classes were doing great. You could do a lot of neat things with the smaller group and then we combined them for one reason or another and it just hasn't been the same.

High School Teacher Comments

- We have heterogeneous grouping of kids.
- We have PUMP algebra.
- My answer is we don't do anything except lower the standards.
- The Equity 2000 tutoring, I think, is one thing that's available to everybody. We've got algebra support system, which isn't working the greatest, but it's there, and if it was being done right, kids could be getting a lot more help in algebra.
- This math lab is an attempt to work with students that are repeating algebra.
- I have to teach all of the kids because their skills are low. Period. There isn't a difference between whoever comes in my classroom, white, black, green, blue, or polka dotted. Their skills are all low, so I don't do anything special for any diverse group.

PROFESSIONAL DEVELOPMENT

Describe staff development experiences, including university courses, you have participated in this year that focused on improving your mathematics and science teaching. How effective were they and in what way?

Many of the elementary school teachers had taken or were currently enrolled in a MUSI-UWM course. A great number of teachers also mentioned that the in-services offered at the

Kluge Science Center were effective. They also cited conventions, conferences , and MSRT in-services as supporting their professional development during this school year.

Almost three-fourths of the middle school teachers interviewed were taking MUSI-UWM courses and all but one thought the classes were very beneficial to their professional development. Some of the teachers also described participation in Equity 2000 and still cited use of the Internet as a resource for professional development.

Attendance at conventions and conferences was cited by high school teachers as the main source of their professional development and as the source most beneficial to improve their teaching. Only one high school teacher also reported taking a MUSI-UWM course in addition to attending conventions or conferences.

Elementary School Teacher Comments

- Six of our math teachers are participating in the Saturday algebra class at the Cosmic Center sponsored by MUSI. I really enjoyed that.
- I took an off-campus class at Tosa East, the Sally Ride Academy, and that was good.
- We've had MSRT inservices that were really good.
- We had a science inservice at Kluge that was very effective. All of the teachers enjoyed it because it was hands-on. We're all like little kids who like to play and learn at the same time.
- The science assessment class at the Cosmic Center was a logistical nightmare.
- The UWM course has helped because I am a lot more aware of what the standards are and what they mean and how it effects your teaching. I have gotten some really good ideas.
- The AIMS workshop I thought was very stimulating it really got me excited about math again but then I came back to the classroom and the information was so fragmented that I honestly haven't incorporated any of it in the regular day. I just pulled out one of the books that they gave us and thought gee this might be neat to use but the time to go through the books and try and find something that fits takes time.
- One of the things that I went to was a teachers convention. That was beneficial because it makes you kind of step back and look at what your doing in math and reinforce that, hey yeah, somebody else is doing what I'm doing, and this is a great idea.
- Two of us have gotten to take the MUSI-UWM science course and we've been introduced to the new science standards plus the MPS content skills that all the children need to be working on plus process skills. The course really increased my science knowledge as to content and instructional practices.
- I attended one workshop this year on a school day. It was one of the district science workshops to teach us how to use the science curriculum and we did one unit in the science curriculum and I found that was superbly done.

Middle School Teacher Comments

- We are the first wave of MUSI schools. I've found the courses I've taken very effective and very helpful to me. It helps your teaching become more integrated and the kids get real excited over it.
- I've attended one of the district science workshops that I thought was superbly done.
- I took a course at UWM. The different strategies to use in the classroom and the books given out were very beneficial.
- I took a university class that was supposed to be hands-on and it turned out to be mostly lecture.
- We don't get information and it gets frustrating when you get information late on an in-service you would liked to have gone to.
- We have little opportunity and we have no help in science that would allow us to go.
- I went to the Shape and Dimension project through UWM and the nice part about that was we had it in the summer with all the theory and all the learning about the materials. Now during the school year we meet once a month and we are implementing the things we learned. What happens often is you get great ideas during the summer, but then school starts and you get bombarded with everything else and its not implemented. So this is one of the nice parts about this project.
- Right now some of the math teachers in the building are taking a course offered through UW-Milwaukee. We meet on Saturdays for eight hours, so we have a long day but it includes different types of strategies that we can use in our classrooms. They are from an excellent book that were also given to us in the class that we can use in our classroom. And we are benefiting a lot from it.

High School Teacher Comments

- I've gone to the AP Biology conferences as well as state and national conventions. Those activities are just phenomenal for coming back with new ideas, new strategies, and seeing what works and what hasn't from other teachers.
- I've gone to Advance Math Network, Algebra Network, and Saturday Academies. These have been very effective for gaining and enriching ideas.
- We've done a lot with our banking time days this year where we've written a school-wide algebra and geometry exam to be given. We've done stuff on the banking time days with our department.

OPPORTUNITIES FOR TEACHERS TO INTERACT

What opportunities are there for you to discuss your mathematics or science programs and to share ideas and resources with other teachers in your school? What opportunities exist at your grade level? What opportunities exist across grade levels?

Banking time days were most often cited as the time colleagues had to share ideas and resources with teachers within and across grade levels. Several teachers, however, stated that banking days presented problems since there was always so much to do during that time.

The next most cited time for teachers to interact with other teachers was at monthly meetings, followed by weekly meetings, and then discussions before or after school. Many teachers remarked that they rarely have opportunities to discuss ideas or share resources across grade levels.

Elementary School Teacher Comments

- It would be nice if we could reflect on what we've done over the years, on what's worked, and what hasn't. There just isn't enough time.
- We meet for 45 minutes each Tuesday after school.
- We have a science committee and a math committee and are required to meet once a month, but we mostly work on projects and don't discuss teaching.
- Our MUSI person holds meetings once or twice a month after school that are designed to discuss and to develop curriculum and strategies. Also that person will come to you and you can meet with on prep time or lunchtime or after school time to discuss any questions that you have. Also we have a full time science person in the building who is very, very helpful. She will bend over backwards to accommodate you if you go and ask her for any materials or supplies or ideas or booklets.
- We have an hour each day for planning and an opportunity to communicate with other teachers about where we are at and where we are going.
- We meet once a week, our whole team, so we talk about anything that has to do with curriculum or instruction or something that someone wants to do for that week so I think that's a good opportunity.

Middle School Teacher Comments

- We're given time like faculty meetings or banking days, but it seems like something else always comes up.
- We have very few opportunities. We seek time out on our own and everything is done on our own time.
- Our math teachers meet every Monday.
- Our school has provided paid time for teachers to meet and discuss plans and content.
- We do meet, but we are not always really productive because, like you said, there are other things like ordering materials that we need to do that you really can't get down to the nitty gritty.

High School Teacher Comments

- There's quite a few opportunities, like banking days and departmental meetings where all of the teachers are available.
- The meeting times set aren't convenient to all people. Some of us teach when the meetings are set.
- The MSRT spans the grade levels.
- I think banking days have been really good, because we don't get a chance to communicate. On those days, we find out what other people are teaching. I never get to see them and I'm on the same floor. Never get a chance to talk to them, so this has been really good, plus they've brought other people in to help us solve some of our problems, some people that have had the same problems. So I think that's good.

IMPACT OF THE MILWAUKEE URBAN SYSTEMIC INITIATIVE (MUSI)

Since you are a first-wave MUSI school, how has MUSI assisted you in improving your mathematics and/or science instruction this year? If you have had an opportunity to interact with your MSRT this school year, talk a little about that interaction.

Most of the teachers expressed an appreciation of MUSI. One teacher even described MUSI as "one of those grants that you dream of programs." The teachers were very appreciative of their interactions with the MSRTs. They commented that the MSRTs provide not only resources, but motivation, coordination skills, grant writing expertise, modeling of lessons, and troubleshooting. The teachers also commented on how valuable the MUSI-UWM courses have been in helping them to improve their teaching.

Elementary School Teacher Comments

- The MUSI-UWM class I took helped a lot.
- We really had nothing in science before MUSI. This is one of those "grants that you dream of" programs.
- The MUSI math class made me more comfortable.
- I got good ideas from our MSRT regarding benchmarks and tying math and science concepts together.
- It would be nice to have a MSRT full time. I don't want to share him.
- Our MSRT is someone who pushes and gives.
- The MSRT just simply brings up things, things that have been tucked away in the back of your head for a long time and this person kind of gives you the feeling that you have the freedom to go ahead and try things.
- The MSRT has helped make the teaching in this school more child centered and having them become more responsible and verbalizing more.
- We have a lot of philosophical discussions with the MSRT, what curriculum and where it should be going and what should be done. I am seeing the developmental levels and how children grow and do at each level and he is really looking for that as far as actual working in the classroom.
- Well I think, the addition of the MSRT to our staff has been a big asset. The MSRT comes to all grade levels and has done hands-on experiments with them.
- I think the MUSI program is wonderful. I'm glad they have it because the MSRT knows things that we can focus on.
- The MSRT has been a great help. This person shows you how to do things, gives me stuff to read, gives me information about the trends and the direction to go in. The MSRT demonstrates stuff and teaches with me and guides you in the direction you should be going. And if I have questions when I'm trying to teach something, you have somebody you can go to ask for help. The MSRT comes and even offers help without me having to go ask and ask for i.
- It's great just to be able to have someone right there in the building. You know you don't have to wait until you go to a class next week. It is just you and this person and its immediate and you don't have to admit in front of a group of people that you know you may have messed things up.
- The only thing I don't like is I don't like sharing the MSRT. We don't like sharing our MSRT.
- MUSI has assisted us in improving our existing programs. They haven't come in and created another program, which is probably the benefit of the style, because the person who comes in, looks at our needs and then reacts to that in the way that they're able to. We've got programs instituted and in place. We're not so much in need of someone to come in and create a program. And so the MUSI, our participation in that has been to supplement what we've already created, and I would feel very comfortable with what we have in science and math, comfortable, but that doesn't mean satisfied. And MUSI has been able to identify a few things that we could improve on, brought in some materials, and then helped us upgrade what we have.
- I think the MSRT has made us all happier to teach science. Our attitudes changed. The MSRT is so good about coming in and talking to us beforehand. It's not just coming in and teaching a lesson that we observe. There is so much interaction between us. About what the MSRT is doing and how it is being done and what we would like. Whereas a lot of people who come in to teach, they just want you to watch them teaching.
- I hope MUSI continues. It's well worth spending the money on it. It has improved the kids' outlook on science, they're eager. Also, whenever we can add to our equipment, it's wonderful.

Middle School Teacher Comments

- The MSRT really gets the ball rolling.
- The MSRT is very helpful in class, with assessment, and getting more equipment.

- I have constantly worked with the MSRT.
- She's pulled away too much.
- The Saturday Academy is really helpful. Keep it going.
- The MSRT brings in things when asked.
- If I ever need anything the MSRT has always been helpful.
- I think there was a personality conflict with our MSRT, but regardless, I still see no value in them.
- It was nice having the MSRT in my classroom, because I would like to get feedback as well as how I'm doing, am I hitting the marks that I'm supposed to
- I think the MSRT has been real beneficial for me just because no one ever comes here to check on me because I'm exed. I can basically do whatever I want so no one ever comes in and says could you use some help with this, do you have any books, do you have any materials. No one has ever done that until the MSRT. It's been really nice to have someone come in and offer to help out and try to get me materials. So, it's been positive for me. I don't like to give up my prep time to talk with the MSRT but sometimes you got to but it's been beneficial for me I feel.

High School Teacher Comments

- MUSI has helped us get resources we haven't had before.
- The MSRT helps with common planning and trouble stuff.
- The MSRT has helped coordinate our math and science instruction.
- The MSRT went into the areas where needed and addressed those needs.
- We really enjoyed and appreciate the MSRT coming in and doing research for us.
- The MSRT comes to the classroom and helps up with the teaching of the graphing calculators, because not everybody knows how to use them.

OTHER COMMENTS

Is there anything else you would like to tell us about your mathematics or science programs or comment on in regards to MUSI?

Elementary School Teacher Comments

- I've told the principal that I've learned more this year than any other year because of MUSI.
- In 11 years of teaching this is the most helpful thing MPS ever came up with. All other programs are one-shot with no follow up.
- There is a need to communicate what the MSRT is there for. I thought the MSRT was there to teach math and science classes.
- The MSRT is only here sometimes. We are confused about this person's schedule.
- The MSRT is spread too thinly, so teachers who don't want to change aren't forced to.
- It's been a real asset having the MSRT here.
- We all happen to teach science and our attitudes have changed because of MUSI.
- I hope MUSI continues. It's improved the kids attitudes. They're eager.
- MUSI could develop math/science centers where we could take our kids, similar to Discovery World.
- I think they should continue with the program. I think that having the MSRT here has been a real asset, an additional resource person to help in the classroom and I think it is beneficial not just for the staff but namely for the kids.
- It's been a good year with the MSRT. Perhaps I would be going in the right direction with my teaching eventually, but I think the MSRT got me going in the right direction faster. I didn't have to stumble around blindly for a while to figure it out.

Middle School Teacher Comments

- The MSRT needs to be utilized more. I see this person as a mentor for new hires.
- The MSRT could do in-services for us.
- There's been a timely response to our requests and needs by the MSRT.
- I hope this program continues.
- The MSRT doesn't seem to be effective or needed much. We need more paraprofessionals. I am used to working independently and see no need for a MSRT.

- If we could have the MSRT around for more time it would be better. Right now I think this person only comes in Monday and Tuesday since he has two schools. That's maybe something we would like to see, a person at one school instead of two schools and that way it would be more effective. And more consistency too and the students will get to know him and see him as part of the classroom.

High School Teacher Comments
- It would be helpful to have a MSRT for science and one for math.
- We need to have more time for the MSRTs and the teachers to meet.
- I am very happy with the program. Our MSRT is a very hard worker who has helped immensely.
- It's nice to know that when you write a grant that you have a chance of getting it.
- We need more coordination between MSRTs, principals, and math and science teachers.

SUMMARY

Teachers from First Wave MUSI schools participated in conversations on teaching mathematics and science. Thirty-five groups of teachers were interviewed for a total of 92 teachers. Fifty were elementary school teachers, 24 were middle school teachers, and 18 were high school teachers.

This chapter presented each interview question with a summary of the responses and a selection of illustrative teacher comments. The following is a list of views that emerged from the conversations with teachers.

Mathematics and Science Lessons
- The elementary, middle, and high school teachers described their most exciting lessons as involving hands-on experiences, experiments, and group work.
- Teachers at all levels indicated that students showed greater enthusiasm and interest ion lessons that were related to something from the real world.

Standards-Based Teaching
- Some teachers were familiar with national standards in mathematics or science.
- Standards or benchmarks had been established within some schools as a guide for instruction.
- Some teachers at all levels indicated that they were not familiar with any standards for teaching mathematics or science.
- The range of the answers regarding standards-based instruction illustrated confusion and contradictions among teachers within the same school.

Needed Resources
- Teachers at all levels highlighted the need for more time to collaborate with and learn from colleagues and time for planning instruction.
- Smaller class sizes, more materials, and replacement of broken items were also cited as needed resources.
- Some teachers noted that they needed a support person, such as the MSRT or a similar person, to be in their school full time.

Technology
- The elementary school teachers reported a range in the use of calculators. Some teachers noted that their students used calculators almost daily and others commented that their students only use calculators once or twice a year.
- A few teachers at the elementary and middle levels commented that their students do no t use calculators.

- Teachers at all levels reported that their students use computers for learning mathematics or science. However, some teachers reported that computer labs were difficult to access or that they did not have access to the Internet.

Assessment Strategies

- The elementary school teachers reported using journaling, observation, demonstrations, and portfolios for assessment in mathematics and science.
- The high school teachers were more likely to state that they use quizzes and tests than teachers at other levels.

Performance Gap

- Many teachers were not aware of any specific efforts to address the performance gap within their schools.
- Some teachers commented that their student population was homogeneous and thus there was not a gap to address or commented that the skills of all of their students, regardless of race/ethnicity or gender, was low.
- Strategies to address the performance gap included using flexible groups, emphasizing collaborative work, and increasing pride in a student's heritage.

Professional Development

- Many elementary and middle school teachers reported that they participated in Kluge Science Center inservices, MUSI-UWM courses, and other workshops.
- The most common professional development experiences cited by high school teachers were conventions and conferences.

Opportunities for Teachers to Interact

- Teachers at all levels explained that they were provided time on banking time days to interact with other teachers in their buildings. However, some teachers remarked that there was always so much to do during a banking time day and that they only occur once a month.
- Some teachers noted that they had some opportunities to discuss ideas and share resources within a grade level, but rarely had time across grade levels.
- Some schools provided encouraged teachers to meet weekly after school and paid them for their time.

Impact of the Milwaukee urban Systemic Initiative

- The elementary school teachers noted that the MUSI-UWM courses helped them to improve their teaching and helped them to be more comfortable with hands-on and inquiry-based teaching.
- The elementary school teachers explained how MUSI has helped to improve their students' attitudes toward learning and that their students have learned more science this year than during any other year.
- Teachers at all levels remarked that the MSRT within their school was able to help them obtain additional materials, equipment, and resources. This often involved the MSRT helping their schools obtain grant money.
- Teachers at all levels noted their appreciation for the assistance provided by the MSRTs. Many commented that they wished they would be in their buildings full time or remarked that the MSRT seems to be spread too thin. Some high school teachers suggested that it would be helpful to have one MSRT for mathematics and one MSRT for science.

CHAPTER 4

CONVERSATIONS WITH PRINCIPALS

Eighteen first wave MUSI school principals were interviewed during the site visits. Three high school principals, six middle school principals, one K-8 principal, and eight elementary school principals participated in the conversations. Eight principals were African-American and 10 principals were Caucasian. Eight principals were male and 10 principals were female.

Interviews were first transcribed and reviewed. Interview questions were then summarized and analyzed to discern any thematic information that emerged from the data. Many themes emerged from the analysis of the transcripts of first wave MUSI principal interviews. For the most-part the themes permeated the data from elementary, middle, and high school principals. There were a few noticeable themes that were specific to a certain grade level, these themes are identified accordingly.

The principal interview protocol consisted of 14 questions. These questions were grouped into the following categories for discussion. Category One includes the principals' rationale for being involved in MUSI. Category two includes the identification of the strengths and weaknesses of the current mathematics and science programs. The third category discusses student achievement and the principals' perceptions of a performance gap between minority and non-minority students. The fourth category involves concepts related to the implementation and support of standards-based mathematics and science instruction at MUSI schools. Category five deals with issues related to parental support and involvement efforts and extending mathematics and science instruction beyond the walls of the school. The last category, Category Six, focuses on the specific work and support of the MSRT at the school building level and the principals' plans regarding the future relationship of MUSI to the school's mathematics and science programs.

INVOLVEMENT WITH MUSI

MUSI supports curriculum and instructional reform efforts underway in the schools.

The major theme that surfaced from the data analysis indicated that the principals viewed their school's involvement with MUSI as a means to support school reform efforts currently underway. Few principals indicated that MUSI provided the impetus for reform, most indicated it provides a means to sustain and strengthen reform efforts already in place at the school or within the district. The majority of the principals believe MUSI is well aligned with reform efforts by providing the school with additional resources including materials, personnel, and staff development opportunities for implementing their mathematics and science programs. One principal stated that MUSI "was an opportunity to have some additional resources, to have additional opportunities for in-service...it really worked to fit right into the direction we were already moving in." Another principal noted, "We already made some primitive efforts to move into a direction that math and science should be going for the 21st century...We were able to meet our needs with the MUSI program."

Some principals also indicated their participation in MUSI has helped promote other efforts such as the school-to-work program. For example, one principal stated, "The thing that has really happened with us, it has moved us further into school-to-work because we were able to now identify more opportunities that are out there for the students."

MUSI provides the philosophical rationale for the reform of mathematics and science instruction.

More specifically, the majority of principals believed MUSI provided professional development opportunities for their staff through UW-Milwaukee course work, MPS in-service sessions, and working one-on-one with the MSRT. Through these professional development activities "teachers are getting a broader understanding of the current philosophies in teaching math and science." In addition, one principal stated that exposure to these professional development opportunities are reflected by teachers "buying into the fact that they need to expand their awareness of current (educational) philosophies."

Principals noted that teachers were developing a stronger knowledge base by furthering their understanding of the philosophies behind effective mathematics and science teaching and district reform efforts. Principals commented that the establishment of this knowledge base amongst teachers in turn "forces you to look at what you're currently doing." It "forces you to set goals, and it forces you to have your staff look at their teaching behavior and their style of teaching." For example, one principal reported that through these development opportunities, "The teachers are becoming more conscious of teaching science and math with manipulative versus (strictly) the book." Another principal stated that participation in MUSI allows teachers to "take a critical look at teaching and learning...to make sure we are doing the best we can."

MUSI provides opportunities for the integration of mathematics and science curriculum and instruction.

Data from the high school principals and a few middle school principals indicated a theme specific to the promotion of the integration of mathematics and science curriculum and instruction. Principals indicated that because MUSI has a mathematics and science emphasis the program would promote the integration of those subject matters within their more departmentalized schools. One principal reported that MUSI would "assist my teachers of science and math to work in defined ways to integrate their efforts with the children." This principal continued by stating the project provided a focus for their mathematics and science staff in their "all working together and integrating the curriculum." Another principal added that "we've been talking about integrated learning...what we had started to do was look at integrated teaching...we had our focus groups...the opportunity came from the National Science Foundation and we were already in the process of doing some things...we thought this would be a great opportunity to help us do that."

STRENGTHS AND WEAKNESSES IN MATHEMATICS AND SCIENCE

The strengths of a school's mathematics and science programs rest with dedicated and enthusiastic staff members committed to the process of reform.

The majority of the principals indicated that the strength of their programs rest with either entire staffs or certain individuals who take leadership roles in promoting more innovative curricula and instructional methods. Other programs, such as Equity 2000 or School-to-Work initiatives, underway in MPS support those efforts as well. Regardless of the reported source of the strengths of the mathematics or science programs, the principals feel that the MUSI project provides the vision and vehicle needed to maintain those strengths.

For example, in mathematics one principal's comments are indicative of the support MUSI offers to build on the strengths of the school, "We feel we have a very aggressive math program. I think like anything as time goes on, it's important we look at new ways of doing things and I think again, the MUSI connection, having that as a resource, will help us maintain our status of being on the cutting edge of what is happening in terms of math instruction." Another principals noted that participation in MUSI challenges the staff in a positive manner, "Our strength is that we do realize that we need to teach kids how to solve problems...they are open to changing their style...they know they cannot continue to go that way (traditional)...that they have to start changing the way they teach."

In science, most principals also believe that their staff is their strength. Here too principals reported their staff keeps abreast of science teaching innovations and district wide reform efforts through participation in courses, in-services, or serving on district wide committees. The strength of the dedicated science staff members was summed by a comment from one principal, "With (teaching) new (science) concepts...many youngsters don't embrace that new concept right away but we have the type of staff that will continue to work with the youngsters in the building, they will continue to redesign their lesson plans, they will continue at it until they hit upon the happy medium where they are starting to reach the youngsters in their classroom."

A strength of a school's science program rests with the provision of either a full time science teacher or science coordinator or a dedicated room used as a science lab.

Specific to middle and elementary schools, principals also indicated a major strength with their science program was related to either a full time science teacher working with teachers, a teacher assuming a role as science coordinator for the school, or having a dedicated room used as a science lab. Additional strengths were related to specific grant related activities provided by external funding. With an MSRT on board at the school, many principals indicated they needed a "science room" to better facilitate the MSRTs role with their science program. One principal reflected, "Many times I wish we had a science room....that is the key to a strong science program. You have the resource person on board but you need a room with the equipment in there...that person along with the classroom teacher can do the things with the youngsters that need to be done." Another principal commented, "I just really wish that I had a science room...I can see this (MSRT) doing so many things if we had that science facility within these walls for the MSRT to work with."

Weaknesses in mathematics and science programs are clearly separated by discipline.

In mathematics, the few weaknesses reported were mostly referred to as challenges rather than weaknesses. These challenges related to moving the few teachers, teachers embracing more traditional methodology to more innovative approaches. It was noted that those teachers more reluctant to change mostly coincided with years of experience; more years of experience seemed to equate to less movement towards reform. Another challenge, as reported by some principals, dealt with increasing the awareness of parents that mathematics instruction has changed with commensurate changes in homework.

A few principals felt that some teachers were too dependent on following the traditional textbook. This in turn makes them less likely to embrace change because they feel "constricted by having to go chapter by chapter no matter what I say as principal...you really don't have to follow chapters in a book...the scope and sequence may be laid out but you have to look at the children's weaknesses and try to teach them through their strengths."

Some principals set forth the notion that "the new philosophies of math are very hard to convey to parents...it was easier to convey to parents the type of skills the children were learning if they had conventional worksheets in front of them that were similar to what they had gone through when they were in school." Another principal stated, "The challenges are that we need to have more of a community understanding of the teaching of mathematics so that when children come home without a worksheet and they have a project to do instead that this is okay."

In science, the reported weaknesses were more wide spread than those of mathematics. Here the reported weaknesses related to the characteristics of program strengths as noted earlier. Reported weaknesses related to science teacher mobility and of not having a person dedicated to teaching science year-to-year. Along this line of thinking, there was a perception of inconsistency in the scope and sequence of the science taught year to year by different teachers. because some teachers are just not adequately prepared to provide effective instruction in science. Also, some principals noted that the inconsistency was with the district's science program itself because a planned sequence of what is to taught at each grade level was not clear.

One interesting theme that emerged from the data related to a reported strength, the building's science teacher/coordinator and science lab or resource room. Principals who reported the use of a dedicated science room as being a strength to the program also indicated that it may be a weakness as well. These principals feared that having a lab or a resource room where teachers and their students go for science instruction, may actually help to isolate the subject of science from the students day-to-day learning experiences. One principal stated, "Even though the classroom teachers are in the science lab with the science teacher and they are expected to co-teach and work with students, probably 95 percent of the science instruction is going on only in the lab. Teachers are not carrying on as much in the classroom with follow through of activities in the lab and that is something we have to work on." Another principal added, "Once you give the responsibility of your science program to one person, the other teachers think that allows them to spend more time in other areas and they start to neglect science...particularly in the follow-up that is needed."

STUDENT ACHIEVEMENT AND LEARNING

Evidence of the positive effects of mathematics and science instruction on student learning was based on increases in test scores for the middle and high school principals. For the elementary principals the indicators of positive instructional effects were based on direct observations of teaching and learning successes in the classroom.

All the high school principals and most of the middle school principals responded that the evidence of the successes of mathematics and science instruction is represented by increases in test scores. The overwhelming majority of elementary principals stated the evidence rests within the classroom behaviors of both the teachers and students. For the elementary principals, they found that test scores do not adequately reflect noticeable positive changes in student enthusiasm toward learning mathematics and science. One principal stated, "I have seen more innovative, creative, solid, good teaching that has been going on, challenging the kids more." Another commented, "Anyone would be able to ascertain (success) by simple observation...many times test scores are misleading, not to say they are not important, but I think if you go into the classrooms, see what is being taught, see what kind of instructional points the teachers are trying to get across, that quite a lot of evidence in itself right there."

Other principals indicated they see a lot of transfer of problem solving and hands-on innovative teaching approaches being transferred to other curricular areas. Students are excited about doing mathematics and science, more group work is going on in classes, and there is less isolation of subjects. One principal stated, "The techniques and strategies we're teaching (in mathematics and science) and the way we teach them to think—that is really helping them to do better in the total picture of their academic progress." Another added, "You have to observe, not everything can be measured by a test."

In addressing the performance gap between minority and non-minority students, principals reported it not to be an issue in schools with almost a homogeneous population of minority students or they reported specific strategies used to address the issue within their school building.

Of the principals who indicated the performance gap was not an issue within their schools due to high populations of minority students, a few added additional statements. Of those few principals who went on to elaborate on this issue, their comments focused on evidence of gender-based achievement gaps. Strategies to address this issue were closely aligned with strategies put forth by other principals who indicated they have minority/non-minority achievement gaps. These principals indicated this was an issue they consistently struggle with. The principals identified strategies for various stages which they used in attempting to deal with the problem.

First, principals reported the staff needs to become aware of the issues and the underlying potential causes of the gap. This awareness is then expanded on in staff meetings and in-services conducted by consultants or district personnel, where discussions focus on identifying various learning and teaching styles and strategies and the alignment of those styles to student achievement. One principal commented, "At this point we are figuring that if we have high expectations and I have some teachers that have training in efficacy...we're doing those types of things to motivate teachers, because I think that one of the characteristics of closing that gap is what the teacher believes the child can do and efficacy training answers that. That is the best program I know for getting teachers to change their thinking."

The next phase in treating the problem, as identified by the principals, related to specific programs in place that deal with the students themselves. Closely aligning the curriculum with assessment was seen as a strategy by some principals. One stated, "We are looking seriously at the curriculum alignment and making sure we are teaching and aligning what is in our curriculum with what is on the test." Looking at the "total program" of instruction was conveyed by most principals as a means to link programs together to deal with student gaps in achievement. "We look at the total program...at the different learning styles, because I think that is where the gap comes with different people learning different ways, and as we start talking about it and plan staff development, we are finding ways that we address the needs of all the students."

Some principals stated their strategy was to provide students with educational experiences that most curricula assumes students have experienced. One principal stated, "A lot of youngsters here are from the heart of the inner city, they haven't had these experiences...give them some material on experiences they have had and you would see a dramatic difference....We're going to try to provide these youngsters with the necessary experiences for them to be successful in the way of field trips or resource people coming in or the teacher themselves getting the kinds of materials and visual aids to help give these youngsters the kinds of experiences where they'll be successful too."

Other strategies include after school tutoring, peer tutoring, heterogeneous cooperative classroom groupings, and challenging students to take more advanced courses. These strategies were seen as inclusive by some principals who expressed the benefits of cooperative grouping. One principal reported they have "broken down the barriers between having classes homogeneously grouped. We have now heterogeneously grouped our kids and are challenging all our kids to high standards and we think that will have a positive impact on all our youngsters."

The principals' perceptions of the comfort level of the teachers in implementing standards-based mathematics and science programs were consistently positive.

Some principals responded that although they felt their staff members were comfortable, the level of comfort varied among the staff. Most indicated the comfort level was constantly rising as the teachers gained more experience teaching and with exposure to staff development opportunities that explored standards-based instruction. Principals reported that their teachers comfort levels hinged on the ability to discuss instructional issues among themselves and the sharing of information. More isolated teachers or teachers who were further removed from professional development opportunities, as one principal indicated, "teachers who have not been in touch with any kind of strengthening or enrichment, in terms of their teaching careers, have some challenges (with standards-based instruction)."

Efforts made by principals to support, focus, and engage the school staff on implementing standards-based mathematics and science instruction involved time set aside on banking days to address these issues and some support of other professional development activities.

Principals indicated they set aside banking days to specifically address instructional issues such as science and mathematics teaching and learning strategies and styles, the use of MPS science kits, identifying learning benchmarks, and the MPS curricular standards. These meetings, as indicated by many of the principals and stated by one, "have gotten them (teachers) into the idea of teaming and working together cooperatively, and then they serve as their own support base." In addition to banking days, the majority of principals supported other professional development activities such as providing funds for conferences, allowing teacher release time for grant writing, and endorsing university based course-work.

Staff development opportunities relating to standards-based instruction clearly involved the buildings' MSRT and other staff personnel in supporting those activities.

The majority of the principals stated that the support mechanisms for standards-based instruction in place at their schools involved the MSRT working in conjunction with a resource teacher or learning coordinator. This team approach with the MSRT was a critical support component. Although some principals indicated other mechanisms such as team meetings, in-service training, grants, and other district based support, the MSRT was clearly identified as the lynch-pin in the support mechanism. This "in-house" support was crucial, as one principal believed, because "the person who (usually) presented the in-service is the one who will be out of the building once the in-service is over, whereas the MSRT is right here in the building. If the teacher is not clear on a particular concept, they can seek out that particular (person)."

Additionally, the few principals that indicated a strong "team approach" to support their staff's professional growth found monies to support those efforts. This idea was conveyed by one principal who stated, "We have a very supportive administrative team. An administrative team that is willing to spend money and make investments in staff development. Give teachers opportunities to attend conferences and conventions where they can get new ideas and kind of refresh the 'batteries' a bit as they move through the school year." Another principal stated that this team-based approach to school science and mathematics reform included all staff members and allowed for teachers to assume "more ownership in what has been done in curriculum development and the materials that are being used."

Opportunities for teacher meetings across grade levels to address concerns in mathematics and science are limited.

The majority of the principals indicated there were few opportunities for teachers across grade levels to meet regarding mathematics and science. Most principals reported their main concern was one of getting each grade level working together before going school-wide. Middle and elementary school principals who did indicate there were opportunities for teachers of different grade levels to work together allotted time for content areas to meet during staff in-service sessions or banking days. When teachers belonged to broader committees such as school steering committees, some principals reported these committees could be viewed as cross grade level meetings but they may not specifically relate to mathematics or science.

COMMUNITY SUPPORT FOR MATHEMATICS AND SCIENCE PROGRAMS

Efforts made to engage families in the mathematics and science education of their students are limited.

Most principals indicated this was an area of need they had to address. Most principals reported they attempted more generic approaches to engage families in their children's schooling, not specific to mathematics and science. The more traditional approaches noted by the principals included parent-teacher conferences, school open-houses, newsletters, family activity nights, and homework hot-lines. The majority of the principals believed better communication with parents was the first step in the school's attempts to draw parents into their children's education. A few principals did indicate they were actively addressing this issue by maintaining an "open-door" policy for parents to come to school and visit anytime. These principals also indicated they were also actively soliciting parent volunteers to participate in school activities. One principal found that establishing a parent center at the school was a successful means to both educate parents and to emphasize the home support mechanisms parents can attempt to embrace when educating their children at home.

Opportunities for students to engage in mathematics and science beyond the walls of the school were related to district-wide efforts such as school-to-work partnerships and field trip adventures.

The majority of principals reported more traditional opportunities for students such as field trips, science fair participation at local universities, and district-wide competitions. Many principals indicated their school's efforts to expand the walls of the school were based on school-to-work partnership field trips or establishing within house businesses in conjunction with the partnerships. Few principals indicated other specific efforts by name. Of the few that reported other specific efforts they included such projects as Equity 2000 Saturday Academies, Community Gardening, or Testing the Waters programs.

MUSI AND THE MATHEMATICS/SCIENCE RESOURCE TEACHER (MSRT)

The MSRTs serve as mentors for less experienced teachers and as role models when providing more innovative mathematics and science instruction.

All the principals reported the MSRT served a mentoring role or as a role model when they conducted classroom activities. Principals made such comments as: "The MSRT has been very instrumental in a number of projects where the MSRT has actually gone into the classroom and modeled an area of science or the helped with various science experiments and activities or provided some staff development assistance in the area of performance assessment." Another principal noted, "The MSRT provides a resource for our staff...the ideas, the hands-on approach, the whole process-problem solving approach rather than rote memorization. The MSRT is working very closely with teachers in the upper grades....We want to keep our MSRT!" A principal also stated, "The plus side of being in MUSI is that we have someone who is coming in and showing them (the teachers) how they could change."

Having a person work one-on-one with the teachers is a vital component when it come to promoting changes in teaching. Most principals indicated this line of thinking as mentioned by one principal, "The MSRT has done many lessons in science. The purpose in this is to show teachers what they can do and then help them do it. You can show the teachers how to do it at a workshop, but it isn't as effective, I still don't think, as effective as someone coming into their room."

In terms of the MSRT providing a role model for younger and less experienced teachers, one principal's comments in particular was indicative of many principals, "The MSRT has been, for a very young staff, kind of a stable, solid, and strong teacher type person that can support, and really strengthen through suggestions and classroom demonstrations, good teaching techniques....Through MUSI and the MSRT the math/science areas are very strong because we have the resources that we can pull from them to help us develop (these areas)."

The MSRTs serve as meeting facilitators and as a part of a school's leadership team when it comes to a school's mathematics and science instruction.

All principals reported the MSRT serves a vital function when it comes to assisting the administration in the promotion of mathematics and science instruction at the schools. Principals reported the MSRT serves as a visible administrative support mechanism for mathematics and science instruction through in-class support of teachers or facilitating meetings and in-service sessions. Principals stated: "The MSRT is involved in the development of our in-service training." "The MSRT is actively involved in faculty and staff meetings." "In the content area meetings, the MSRT takes a leadership role." "The MSRT has taken the leadership role of arranging our family math night." "The MSRT has been instrumental in developing an in-service for science teachers."

Principals also indicated that the MSRTs know their subject matter well and they, therefore, become a part of the schools' mathematics or science program strengths. One principal commented, "The fact the MSRT knows the subject matter...they become a teacher leader. I feel very fortunate that we were able to get the MSRT as a part of our program."

The MSRTs provide an informal feedback loop for both teachers and administrators regarding the state of affairs in mathematics and science instruction.

Most principals reported the MSRT serves as an informal feedback loop between the administration and the teachers. Principals stated: "The MSRT is seen as a real linkage between me, the learning coordinator, and the teachers." "Communications back and forth between us allows a very positive working relationship (among the staff)." "The MSRT is the resource person who can be in touch with the classroom teacher to see what they are doing."

Of the principals who reported on this information loop, they were clear in indicating the information was not evaluative in nature. They also maintained that it was important for the MSRT to establish rapport with the staff. One principal stated, "The MSRT meets with me often ...constantly gives me feedback on the things that work and the things that don't work, and they are not evaluations of teachers. We don't go into those type of things." Another principal stated, "The MSRT has a trustworthiness about him/her that teachers can talk to him/her in a non-threatening way. The MSRT is able to work side by side with another (educational) professional and not come across as being the supervisor type of teacher but as a mentor teacher and a helping teacher and as a co-teacher and I think that is a strength."

Another principal noted, "The MSRT observed teachers first and not an evaluation observation...to see where the teacher was at in terms of his or her teaching styles."

Many principals also indicated that communication needs to be maintained when the MSRT works one-on-one with the teachers to the extent of identifying and providing materials for the teachers as they continue to improve. One principal indicated that through consistent communication with the MSRT they can continue to provide "materials the teachers will need to carry on what the MSRT has started (with the teacher)." Another principal added a summative statement about the MSRTs' effective brand of communication; "The MSRT's willingness to work directly with math and science...so approachable...full of all sorts of ideas...teachers feel very comfortable talking with the MSRT. That has been the greatest."

The MSRTs serve as a resource, a communication focal point for soliciting grant monies, classroom materials, and professional development opportunities.

All the principals found the MSRTs to be another resource for the school to enhance mathematics and science instruction. One principal clearly relayed the positive tone of the MSRT role, stating that "a resource person coming in like this enhances instructional programs." Another principal remarked, "Prior to this (MUSI participation), we had a science room that needed a lot of help and through the help of MUSI, the MSRT was able to go in and look at the resources we had ordered and get it going. This year is the first year that our teachers have not just ordered the science kits but actually used them and embellished the ideas (of the MSRT)."

Another principal mentioned that the MUSI grant has allowed "us to bring in an additional human resource...the MSRT assists teachers in their collaboration efforts, as well as bringing in resources. Because the MSRT has a little bit more flexibility and more time than the teachers do...they have the ability to assist and bring to them things they may not necessarily be able to go out and get themselves." One principal related a story about their MSRT doing the "nitty gritty" work of bringing a teacher up to date. "We had a new teacher who had been out of teaching for about 20 years, who decided he wanted to teach again, and of course had to be updated on teaching techniques...so the MSRT helped him to develop a unit plan. That is the nitty gritty work, to sit down and write things out, and the MSRT did that...went in, spent time, showed him...that kind of stuff." The principal continued, "Just having the knowledge of content that the MSRT has and being able to work with teachers...the MSRT is invaluable to us."

Many of the principals reported individual grant writing efforts spearheaded by the MSRT to identify material acquisition funding sources or monies to be used for teacher training. One principal reported on a $10 000 grant written by the MSRT and learning coordinator to purchase and train teachers on graphing calculators. Another principal reported on a similar grant writing excursion by an MSRT to obtain materials and teacher release time for extended training sessions. A principal noted, "The MSRT is involved in grant writing, assisting us to get additional monies to support our in-service staff training, and material acquisitions."

In terms of other professional development opportunities, the principals expressed how helpful it was for the MSRT to provide information to school staffs regarding these other opportunities. Many principals stated: "The MSRT has been coordinating a lot of staff development activities...either through UWM or things the district is offering. The MSRT has been instrumental in getting our teachers signed up." "The MSRT started bringing in any type of information he/she could find about in-service classes related to math and science." "The MSRT found net-working opportunities and also staff development opportunities, and then the MSRT offered whatever other support that he/she could give." Some principals even reported that this "take charge" attitude of the MSRT in terms of professional development has "rubbed off" on other teachers who are also pursuing leadership roles within their schools. One principal stated that through an in-service opportunity promoted by the MSRT, "Our third grade teacher then became the lead teacher at in-servicing the rest of our teachers."

Principals' facilitation of the MSRTs work varies widely from informal meetings to installing them as a regular member of the school staff.

Most principals indicated their facilitation of the MSRTs' work was best achieved through an "open-door" policy with the MSRTs, to ensure the lines of communication were always open. One principal explained, "The MSRT has been able to have time with me when the MSRT needs it. To discuss various issues...often after school, we'll sit for 45 minutes to an hour and just have very open-ended, kind of free discussions and exchange of ideas." Another principal reported, "I encourage the MSRT to come to me with any and all ideas...I've been very receptive to everything he/she has come to me with...whatever cooperation I can give, my AP, my staff members, whatever cooperation we can get to help the MSRT get the instructional component across...whatever we need to order, we'll do it." Another principal mirrored this statement by saying, "I give them the freedom. I trust the MSRT's judgment.... The MSRT is the expert in the science area and I am not. I need the MSRT as a resource to guide me and say this is what I suggest that you need for this school...I'm not the expert here!"

Other principals further extended their support by also providing funds for the MSRT to use. "The best support I can be for the MSRT is to give the MSRT the materials the MSRT needs to do the job. It is like a painter not having a paint brush. You can't do your job paining if you don't have the equipment to do it.... So if you give the person the equipment they can do their job." Another principal mentioned, "I was able to provide some staff development funds for the MSRT as the MSRT wanted to work and spend time with these teachers in curriculum development."

Most of the principals indicated the proper facilitation of an MSRT's work was best accomplished by ensuring the staff clearly understood the MSRT's role and by giving them an "office so they could have a home." Most principals added to the theme of facilitating the MSRTs' work by making them feel welcomed, providing them with a working space, and ensuring the staff was knowledgeable of the MSRT's role in the building. One principal commented, "When you walk into a building and you don't have a place to hang you hat or a place for mail you don't feel that you belong so that is the first thing we did....There was a great big welcome sign.... Everybody knew the MSRT was coming in and the MSRT also shares an office...so the MSRT has a place...that you can call your own...that was one of the first things. The second thing we did was make sure the teachers understood the MSRT's role and that the MSRT's role was clear from the get go. That always has to be refreshed because people forget so we've refreshed them a number of times during the course of the school year."

Role clarification was reported to be important in facilitating the MSRTs' role by most principals as they made statements such as: "The MSRT and I talked about what we wanted the MSRT's role to be....We didn't want the MSRT to go in and teach for the teachers, we wanted the MSRT to go in and show them, give them examples of how they could do hands-on science." "The MSRT attends our staff meetings so that the MSRT is a part of the staff not somebody from the outside coming in."

The MSRTs' subject matter focus was associated with the information principals provided regarding program related questions.

It became clear when analyzing the interview transcripts that during the interviews the principals whose MSRT's focus was science, that principal spoke at length about the science program at the school and discussed the MSRT's role with a slant towards science. The same was true if the principal's building MSRT had a focus on mathematics. Even though the MSRTs work was to enhance both mathematics and science, this cross-disciplinary emphasis of the MSRTs' work did not come through during the principals reflections of MUSI. A few of the principals even commented on the subject emphasis of the MSRT. One principal stated, "The MSRT has been more, probably more active in science than math." Another observed, "The MSRT is very knowledgeable...he/she knows a heck of a lot about math, and science as well...though the math would probably be first and science second...The MSRT doesn't hesitate showing you or telling you that." One principal elaborated on this point by stating, "This is another false premise, that people that were science teachers can just automatically do this integration in math or vice versa. That is as much as a learning experience for them as it is for the teacher in the classroom."

Some principals indicated the program should acknowledge there is a slight disparity in the content emphasis of the MSRTs and attempt to address the problem by allowing the schools to draw from a pool of MSRTs to emphasize certain strengths. For example, one principal stated when discussing science in-services, "I don't know whether my MUSI math resource teacher is the one that would be able to provide those. But I would like for the resource to be available, for me to be able to call on perhaps one of them in the program. Somebody from the pool (of MSRTs) to come over and actually model science teaching...to bring together what the math/science resource teacher is really trying to accomplish."

Some principals raised various logistical concerns such as scheduling and financial accountability.

Logistical concerns regarding the schedule and selection of the MSRTs and financial issues were raised by some principals. One principal indicated the sense of control over the MSRTs work relates to the split scheduling of the MSRT between two schools and not being in the building week-to-week. Another principal indicated that although the MSRT might be scheduled to work in their building, other meetings or extended work at the MSRT's other school interfered with the schedule. This principal stated they needed "to have a better idea of the MSRT's schedule...so they would know that those are the days that they can count on them being there, that they can plan things, that they can set up in-services." Another principal remarked, "It made it difficult to proceed with the plan (reform) when you don't have somebody in the building on a regular basis...and then finding out they are going to be gone for three or four days at this kind of thing and that kind of thing."

A few principals were greatly concerned over the removal of good science or math teachers from their buildings to participate as MSRTs in MUSI. One principal stated the project may not be "very valuable to us (building principals). The effect of it is to consistently be taking the best of our classroom teachers out of the classroom in order to change classroom instruction...I think that people are very skeptical of its value. We are, as a group, very afraid that next year we are going to lose our best science teachers to the project... and I don't think anyone is listening to that concern."

Another principal indicated that although they may have received an MSRT back in their schools to replace the teacher lost to MUSI, valuable reform time was lost. "I was very disappointed that I was not able to keep our teacher who was selected to be a MSRT....I think we lost an incredible amount of time because we were not allowed to keep the person in this building." This principal continues by stating that it "took quite a number of months for the MSRT to figure out exactly where we were at and where we wanted to go...I'm not sure we needed input from somebody who came in not knowing the building and not knowing the staff." This principal also remarked, "I just don't see that a good rapport has been established between the MSRT and our staff." Coincidentally, the same principal responded that their facilitation of the work of the MSRT was minimal. The principal stated, "Probably not as much as I should have...it has been an incredibly busy year...so I haven't spent as much time with the MSRT as I would have liked to."

A few principals also expressed concerns over financial documentation issues required by the project. For example, one principal stated, "I've got some concerns about how I'm supposed to be keeping my financial records in terms of reimbursements or in-kind services." Another principals remarked that the financial accountability is somewhat confusing, "I really haven't gotten any clarification on that yet...I need some support at this point in time."

Some principals raised issues regarding their input into MUSI and specifically to the MSRT role in their school.

Having a sense of control over the program was another issue raised by some principals. A few principals indicated that they feel they have little control or input regarding the actual work done by the MSRT. Aligned with this concern is the notion that the MSRT is really not a staff member under the auspices of the principal, more so they are working for someone outside of the principal's building. One principal mentioned, "We have to have more control of the program. It's difficult for me to move the program forward if other people have control over the people (MSRTs)...I mean they (MUSI leaders) have to be in the building and they have to be here working with us...what I see happening is they are giving them all these things...they are making the decisions based on what they need rather than letting us sit down and say this is what I see as a need. Or us going to them and saying we need this, will you set up this kind of thing for them." Another principal similarly commented, "As soon as you get people making decisions that are not in the building on a day-to-day basis, their intentions are good, the intentions are always good, but they are not necessarily hitting the mark all the time."

Few major changes are planned for most schools' science and mathematics instruction for the next school year as they have already embraced the initial push for reform and the staff has begun moving forward.

Most principals indicated the initial push was already underway and they needed to continue to fine tune programs already initiated and to clearly emphasize the importance of mathematics and science instruction to the schools' staff. This emphasis will most likely manifest itself through more professional development time allocated to mathematics and science and the acquisition of more classroom materials and other innovative instructional resources. Principals stated: "We are just going to continue what we are doing that we know is working." "We are going to continue with curriculum alignment, provide additional staff development in the area of hands-on integrated curricula, problem based learning...and trying to bring the community into the classroom or the classroom into the community."

In addition, a few principals indicated that they needed to focus more on MUSI in the coming school year, regarding the project's goals and required commitment of the school's administration. For example, some principals indicated they needed to do more follow through with their staff based on the ground work provided by the MSRT. One principal stated, "I still need to monitor, to make sure the teachers are actually changing their teaching style...it is all well and fine that the MSRT is showing, but I don't think that enough teachers are teaching hands-on.... My goal is to get in there and use their planning time to talk about what they should be doing because math and science is crucial." Another remarked, "I always knew math and science was important but I think that since I have been in this program this year its like all of a sudden that is where we need to focus.... Your going to be a lot further ahead if you're very competent in math and science. There is so much out there that you are trying to focus on but we are involved in MUSI and that is a priority."

Other principals indicated that as their two-year participation in MUSI draws to a close next year they needed to ensure the efforts put forth in reform become institutionalized. One principal expressed this summative idea by stating, "I hope that the work we are doing here, which has been laborious and it is a labor of love, I hope that with the reform that has gone on at (the school), that we will serve as a model for new schools coming forth. With the helping hand we've had for these two years that this effects sustained change. That as time rolls on the change will be institutionalized rather than cosmetic and that it will become part of how we do business."

SUMMARY

The summary that follows reiterates the themes that were gleaned from the analysis of the principal interview transcripts. These themes should be considered as representative of ideas expressed by the majority the principals that were interviewed for this study. These themes may not be indicative, generalizable, or representative of the experiences of all the principals participating in the MUSI project.

The principals indicated their schools' participation in the project was aligned with, and further promoted, reform efforts underway in the schools. The principals looked at MUSI participation as a means to further the system-wide reform efforts at their particular schools. The MUSI link with system reform efforts was mainly identified by principals as the establishment of professional development opportunities for teachers. Principals indicated it was through these professional development opportunities that teachers reflected on teaching practices, other instructional issues, and the process of change. The principals also viewed their participation with MUSI as being closely identified with the roles of the MSRTs in their schools. This more individualized school support was seen as being manifested through the resources the MSRTs provides their schools. These resources include taking a leadership role in staff development, serving as mentors and role models for teachers, and through the identification and acquisition of classroom materials.

Principals indicated the strength of their current programs in mathematics and science rests with the strength of their staff members. Principals reported their staffs to be enthusiastic and dedicated. In mathematics, the principals indicated their teachers are up-to-date with, and embrace, innovative mathematics instruction. In science, the principals mentioned that the provision of a staff member committed to science instruction, or an area designated as a science room/lab enhanced the role of the MSRT within their school and impacted the overall effectiveness of science instruction in the school. Principals also indicated they needed to monitor classroom work by teachers to ensure the teachers follow through on the work done by the science person or within the science room/lab. Other with-in school opportunities for staff members to work across grade levels were minimal as reported by elementary and middle school principals.

Weaknesses in mathematics and science instruction were related to the comfort levels of teachers in embracing reform efforts. The comfort levels of teachers in standards-based mathematics and science instruction varied with the staff in terms of teaching experience and willingness to commit to the process of reform. Principals reported more comfort with reform efforts come with increasing teacher experiences with standards-based reform through in-services and working with the associated materials.

Although many upper grade level principals reported that test scores are indicative of the effectiveness of the mathematics and science instruction in their schools, the elementary principals indicated that additional information gleaned from direct observations of teaching episodes and student learning are better suited to analyze the effectiveness of mathematics and science programs. Many principals indicated there was little evidence within their schools pertaining to a performance gap between minority and non-minority students. These principals' schools also served a homogenous population of students. Other principals mentioned that awareness of the issue and communication of intervention strategies though professional development activities of their staff was crucial in minimizing the gap.

Opportunities for family outreach and out-of-school involvement with families and the community were reported as areas the principals need to address. Aside from the traditional outreach efforts such as conferences, open-house, and "family nights," few principals reported ongoing interaction with families. In terms of community involvement and out-of-school activities for students, again principals reported on more traditional avenues such as field trips and school-to-work partnership experiences.

As previously mentioned, the work of the MSRT in schools was viewed by principals as being the linchpin of MUSI's impact on their schools' mathematics and science instruction. MSRTs provided a plethora of various duties within the individual schools and performed both instructional and non-instructional roles. Instructional roles included modeling lessons, working one-on-one with teachers, and co-teaching lessons. Non-instructional roles included aiding in the development of in-service programs, lesson development, grant writing, and establishing a communication link between the classroom and the principal. Principals reported the most effective vehicles used by them to facilitate the MSRTs' work included open communication channels with administration and staff about MUSI and the MSRTs role, a willingness to allocate funds for materials and science and mathematics in-service sessions, the provision of a place for the MSRTs to "hang their hat" and to help the MSRTs feel welcomed as a member of their staff.

Most principals hoped to continue the work initiated this year with MUSI by keeping a focus on mathematics and science at their schools. This focus would be supported by a more visible emphasis on the importance of mathematics and science to student achievement. Some principals expressed concern over how the MSRTs were selected from their schools and more specifically, concerns over the subject matter emphasis of the MSRT and their ability to effectively work with both mathematics and science instruction. The last concerns expressed by some principals related to the lack of input they had regarding the services provided by MUSI and the lack of day-to-day supervision of MSRTs in their buildings.

CHAPTER 5

CLASSROOM OBSERVATIONS

Observations of classroom teaching and student learning were conducted during site visits to a sample of 18 First Wave MUSI schools. The observations occurred in April. Observations were scheduled for two mathematics classes and two science classes in each school. Scheduling allowed two additional classes to be observed in the schools for a total of 74 classroom observations. The distribution of observations across grade levels and content area are show below.

Level	Mathematics	Science	Total
Elementary School	18	16	34
Middle School	12	13	25
High School	6	9	15
Total	38	36	74

Using a Classroom Observation Guide (see Appendix B), observers focused on eight specific areas. Completed observation forms were analyzed according to these categories:

- Tools and materials used by teachers and students.
- Classroom environment including seating arrangements and appropriate space and furnishings.
- Equity in student groupings and teacher/student interactions.
- Student engagement, tasks, and activities.
- Instructional techniques, teacher tasks, and activities.
- Student focus and participation.
- Connections to students' lives, other subjects, careers, and culture.
- Assessment techniques.

Summaries of the classroom observations are given for each level—elementary, middle, and high school—by subject area. The two major organizing themes for the summaries are learning environment and instruction and assessment. Illustrative examples of observer comments are provided to support the summaries. The observers provided information through field notes which included comments, narratives, and a check list. Results of these classroom observations were analyzed and summarized to answer the question, "What does mathematics and science education look like in MUSI schools towards the end of the first year of implementation?"

ELEMENTARY SCHOOL MATHEMATICS

A total of 18 observations of mathematics lessons were made at nine elementary schools. The distribution of various grade levels is shown below.

Grade	Number of Observations
Kindergarten	1
Grade 1	5
Grade 2	2
Grade 3	2
Grade 4	3
Grade 4-5	1
Grade 5	4

Learning Environment

Tools and materials used by teachers and students. Classroom observations revealed that 89 percent of the students in the elementary mathematics classes used a variety of manipulatives and hands-on materials. Manipulatives included counters, cards, paper plates, candy pieces, folding paper, fractions wheels, various small objects, plastic coins, piggy banks, and pattern blocks. Other hands-on materials used were math games, crayons, story mats, and paper. Students used the chalkboard in 33 percent of the observations, worksheets in 16 percent, measuring tools such as balances or rulers in 16 percent, and calculators in 11 percent. One class of students used textbooks. No computers were in use by students during observations, although some observers noted that computers were in classrooms. One class was reported as using only paper and pencil and one class was reported as using only the chalkboard.

Observers reported that in 33 percent of the lessons, teachers used overhead projectors with some also using overhead manipulatives. Several teachers also read trade books to the children as part of the lesson.

Seating Arrangement and adequacy of space and furniture. In the observed elementary mathematics classrooms, 53 percent had students arranged in groups, 26 percent had students in rows working individually, and 10 percent had students arranged in pairs. Ten percent of the classrooms were arranged to work as a whole group for the observed lesson.

Eighty-nine percent of the observations reported adequate to excellent furniture and space provided for the children. One classroom was rated as okay with desks arranged in a U-shape, but it seemed somewhat crowded. One observer did not report this item. The following are examples as stated by the observers.

- Some time was spent on the rug as a whole group, then the students worked in smaller groups at round tables and then came back as a whole group to divide their cookies.
- A nice room, bright, very clean, uncluttered.
- Enough room between working areas and plenty of desk space for the activity.
- Lots of fun stuff in the room and on the walls.
- Large room with groups of desks situated so teachers can see all students and can easily move around.
- The room arrangement does not allow for children to work cooperatively although there was no evidence of that type of work in this lesson.

Equity in grouping and teacher/student interactions. The race/ethnicity distribution of the students in the observed elementary mathematics classes reflected the diversity of the students in the school. Observations were made of the diversity of student seating arrangements and pair or group membership in terms of race/ethnicity and gender. Eighty-four percent of the classes observed had well-mixed groups by gender and 16 percent had same gender groups. Seventy-nine percent of the classes had mixed racial/ethnic groups and 16 percent were segregated by race in those classes whose makeup was multi-racial. Three classrooms were comprised of African American students only.

- The students work together, sharing answers
- The students were all African American. The girls sat together and the boys sat together.

Most teacher-student interactions were equitable with observers recording 95 percent of the teachers interacting with all students. One teacher was observed to call upon only one racial group of students.

- Both teacher and aide moved around to all tables to see how students were doing and asked assessment/prompting questions. The teacher asked more open-ended questions and the aide intensively helped with students who didn't really "get" the project.
- She is very good with complementing all students or if they are struggling, saying, "That's okay, let's work it out together."
- The teacher interacts equally with students that have gotten off task and those who need to move on to another area.

Instruction and Assessment

Student engagement, tasks, and activities. As the lessons evolved, observers recorded the different tasks and activities in which the students were engaged. In 33 percent of the elementary mathematics observations, students worked in small groups on collaborative tasks at some point during the lesson. Students demonstrated their understanding to the whole class in 55 percent of the classes. In 55 percent of the lessons students engaged in solving open-ended problems with students explaining different ways to arrive at the same solution. Students also practiced routine computations in 55 percent of the lessons .

In 40 percent of the observations, students were engaged in higher order thinking skills at some time during the lessons. In 25 percent of the classes, students were observed posing questions or problems for other students to answer or solve.

- The students were busy answering questions posed by the teacher and building their responses off of each other. They worked individually, but could talk as they drew or traced objects and measured then with rulers.
- At the beginning of the lesson, the students were sitting at their seats, raising their hands to come up to the front of the room to find and name the shapes. In the middle of the lesson, they were working independently to make designs and copy them onto their sheets.
- The students were writing math problems on the board and drawing pictures to illustrate division problems. Example: Mr. Jones has 18 donuts in six boxes. Each box should have the same number of donuts.

Instructional techniques and teacher tasks and activities. Teachers used various techniques during the mathematics lessons. The instructional techniques used the most by teachers were questioning to guide discussions and assess the student understanding and guiding and helping students while they were working on problems. Other activities included observing students as they worked, giving instructions, demonstrating, praising students, correcting homework answers, and keeping order in the classroom.

- The teacher asked lots of questions, gave directions for the task, and then went from group to group to clarify the task, answer questions and assist.
- The teacher was going from table to table to help students along. The teacher encouraged students to help each other and combine strategies.
- The teacher demonstrated, observed students, pointed out different ways of doing the same problem, and praised the students.
- The teacher was always asking questions for understanding.

Student focus and participation. Observers were asked to describe the major way student activities were structured in elementary mathematics classes. In 28 percent of the observations, students worked in groups or pairs for the entire or major part of the lesson. In 11 percent of the observations, students worked as a whole group part of the time and in small groups or pairs for the other part of the lesson. Students worked individually with individual teacher help for the entire lesson in 11 percent of the observed classes. In 50 percent of the lessons, students worked as a whole group then worked individually.

- The bulk of the time was used for the students working together.
- Half the lesson was listening and observing, half was manipulating objects, weights and scales.
- The students were physically showing the concept of fractions. First, one group went up to the board to demonstrate characteristics, then a new group. They played "Guess My Rule" in which the teacher gave the rule and the class guessed the characteristics.
- The students were telling stories and solving word problems. Each student had a story board and about eight plastic dinos to act out the stories, to model the equations, and to tell their own stories.
- The students were engaged in large group problem solving at first. They then moved to 3 to 4 person tables to work on individual projects. Students at many tables helped each other, but work was not a group project, rather each student was to come up with his/her own solutions.

Other observations were made which described the extent to which the students participated in the lesson. In 78 percent of the classes students were engaged and actively involved in the lesson all or most of the time. One class of students showed disinterest and lack of involvement in the lesson. Evidence of participation was not recorded for the other lessons.

- Students were attentive and engaged throughout the lesson. Many students volunteered answers and were engaged in the weighing process.
- The teacher had no problem getting students to actively participate and she solicited almost all students sometime during the lesson. All students responded when called on. None appeared to have any difficulty in responding appropriately.
- The closer to the teacher the students were, the more focused they were.
- This lesson took on a game atmosphere that kept the students' attention and the teacher showed a sense of humor to the replies of the students.

Observers were asked to describe who did most of the talking during the mathematics lesson. The teacher did most of the talking in 44 percent of the lessons and students did most of the talking in 11 percent. the teacher and children shared equally in talking during 44 percent of the observed lessons.

- The teacher. She told most of the stories and asked students questions. She repeated/reinforced 1+3 stories. She said, "Marcus has . . ." and "Taisha has . ." but didn't have the students tell the class what they had.
- The students did most of the talking. The teacher was a facilitator and encourager.
- The teacher did most of the talking—giving instructions and answering questions.
- First half was "teacher talk" primarily. Second half was "student talk" while working on an assignment.

Connections to students' lives, to other subjects, and to careers. The presence of real-world connections in the observed elementary school mathematics lessons varied, but were generally more prevalent to objects or events in their lives than to careers. The only observed connections to other subject areas were reading and writing.

Thirty-two percent of the lessons made no connections to the children's real world. Sixty-eight percent of the lessons connected to the students' lives, with objects and topics such as real-life story problems, games, sharing, clothing, food, math in games, and references to middle school. Most of these connections were minimal or a very minor part of the lesson.

- The teacher used the students' names in the story problems.
- The teacher explained that every time there is sharing going on, we do division.
- Talked about cutting a pizza different ways to share among different sized groups.

In 95 percent of the lessons, there were no observable career connections. One teacher referred to scientists. There was also no evidence of cultural connections. Twenty-one percent of the lessons had reading or writing connections. One lesson included some art.

Assessment techniques. Observers were asked to comment on what strategies teachers used during the mathematics lesson to gauge student understanding. Some teachers used a variety of different assessments during a lesson. In 95 percent of the lessons observed, teachers assessed by asking students questions. Students wrote in journals or had some other written assignment in 10 percent of the lessons. In 50 percent of the lessons, students demonstrated their solutions to the class or to each other.

- There was questioning of individual students. Some were open-ended, example: Why do you say that?
- The teacher showed two ways to work a problem. Always asked questions rather than just telling the students. The teacher observed students create story problems and gave opportunity to make corrections.
- Asked students for evidence such as "Show me that part of the story."
- Posed questions to the whole class, questioned small groups, and one-on-one questions.
- Appeared to be no formal attempt at assessment during this lesson. Student understanding as a group seemed to be determined through the solution of the problems as they worked on the board.

ELEMENTARY SCHOOL SCIENCE

A total of 16 observations of science were made at 9 elementary schools. The distribution of various grade levels is shown below

Class	Number of Observations
Kindergarten	2
Grade 1	2
Grade 2	5
Grade 3	2
Grade 4	2
Grade 4-5	1
Grade 5	2

Learning Environment

Tools and materials used by teachers and students. Students in 94 percent of the observed elementary science classrooms were working with a variety of materials and equipment. These materials included such items as batteries and wires, seeds, water, rulers, marbles, magnifying glasses, balls, buttons, vegetables and much more. In 35 percent of the classes, students also had worksheets or lab reports to fill out. One class was engaged in giving oral reports as part of projects they had completed. Use of books during lessons was not reported. In addition to these tools and materials, teachers also used the chalkboard during 31 percent of the lessons and the overhead projector in 13 percent. Other tools used by the teacher were laser disks, charts, and science equipment.

Seating arrangement and adequacy of space and furniture. In 87 percent of the elementary science classrooms, students were arranged in groups or in pairs, while none of the students were in rows working individually. Thirteen percent of the classrooms were arranged to work as a whole group for all or part of the observed lessons with the students sitting together on the floor.

Eighty-one percent of the observers reported adequate to excellent furniture and space provided for the children and teachers. Three classrooms were rated as okay, seeming somewhat crowded. The following are examples as stated by the observers.

- It's a small room for Kindergarten, but OK.
- The children can talk in their groups and also see the teacher.
- Individual desks pushed together into tables of 4 or 5. The arrangement was conducive to cooperative learning with enough room to work.
- Slightly crowded with crayons and books on the desks along with science materials.

Equity in grouping and teacher/student interactions. The ethnicity/race distribution of the students in the observed elementary science classes reflected the diversity of the students in the school. Observations were made of the diversity within seating arrangements and group membership in terms of race/ethnicity and gender. In 56 percent of the classes observed, there were well-mixed groups by gender. Whereas 38 percent of the classes had same gender groups. Students sat in mixed racial/ethnic groups in 56 percent of the observed classes and they were segregated by race in 25 percent. The observers did not report on this item in the other classes as all students were African American.

- Boys and girls are mixed in the circle, but at the tables the groups are all girls or all boys.
- The boys were reprimanded more than the girls.

Most student-teacher interactions were equitable with observers recording 94 percent of the teachers interacting with all students. One teacher was observed to not have interacted with one pair of students. The following are examples as written by the observers.

- Students seem to like, respect, and obey the teachers. She calls all students by name and engages all equally.
- The teacher absolutely engages, encourages, and interacts with all the students. Everyone participated several times, both in giving answers and in doing the activity.
- Both teachers moved around to assist all students in the write up of their experiment.

Instruction and Assessment

Student engagement, tasks, and activities. As the lessons unfolded, observers recorded the different tasks and activities in which the students were engaged during the elementary science lessons. Students worked in small groups on collaborative tasks at some point during the lesson in 63 percent of the observations. Students demonstrated their understanding to the whole class in 25 percent of the observations. In 50 percent of the lessons, students were engaged in solving open-ended problems.

Sixty-nine percent of the observations reported that students were engaged in higher order thinking skills at some point during the lessons. In 22 percent of classes, students were posing questions or problems for other students to answer or solve. In 69 percent of the classes, students conducted a structured demonstration of a scientific phenomena or concept. In 44 percent of the classes, students were given opportunities to create and plan their own investigation of a scientific question or problem.

The following is a list of activities, skills, and tasks recorded by observers in which the students were engaged:

testing
sorting
listening to the teacher
asking questions
measuring
constructing own lab reporting
conducting structured experiment
conducting structured demonstration
listening to student reports
observing
answering questions
predicting
discussing findings
classifying
inferring
comparing
reporting
recording data
problem solving
writing in journals
investigating own ideas
communicating discoveries
hypothesizing
completing worksheets

The following are examples as written by the observers.

- Students were asked to test various objects with water, whether it will soak or bead up. They chose an object and tested it, then put into an appropriate group on a sorting tray.
- The students volunteered eagerly to disclose what they had learned about their substances.
- The students were exploring with supplies determining what they could use for their car/vehicle. They worked in pairs, problem solving.
- All students were involved in the experimentation and were animated and interested. There were problems such as not enough droppers. With only two per group, there was cross-contamination that could impact what the students were looking for which were the evaporation rates of three liquids. Students were also having problems reading thermometers. Some had difficulty following the directions and didn't check the instructions written on posters on the board.
- Cooperative planning of the lab, shared responsibilities in presenting the plan, cooperative conducting of the experiment, group sharing of discussion regarding results and learning were undertaken in the lesson.

Instructional techniques and teacher tasks and activities. Teachers used various techniques during their science lessons and became engaged in more than one activity as their lessons evolved. The instructional techniques observed the most by teachers were asking questions, during whole group discussions or while working with individuals or small groups; helping, redirecting and encouraging students as they worked; and giving instructions. 94 percent of the teachers were observed to ask open-ended questions at least some of the time. Other teacher techniques, tasks and activities observed were:

explaining and clarifying
modeling for students
passing out supplies
recording data for whole class
facilitating discussion
reviewing
directing ideas
asking for clarification
demonstrating
monitoring behavior
guiding investigations
observing students

The following are examples as written by the observers.

- The teacher asked mostly factual questions and a few open-ended questions.
- The teacher used the overhead to model filling out the data sheet.

- The teacher reviewed different kinds of temporary magnets, described an electro- magnet, explained the procedure, and told the kids what to do. She explained that when they were done they would change the variables. The students got their materials and began to follow the teacher's directions. The teacher walked among the students, encouraging, questioning, and offering suggestions. The teacher used technical vocabulary. The students were not recording anything.
- The teacher walked between groups encouraging sensory observations. Asked the students: What would happen if . . .? Is it the same as . . .? Did you try . . .? She encouraged the students to manipulate, observe, and experiment with the objects on the desk before them.
- Thought provoking ideas and questions were used throughout the lesson by the teacher and the students. The teacher did most of the talking, but through questions there was a great involvement and verbal participation on the part of the children.
- The teacher monitored the small groups, gave directions, and gave supportive comments regarding cooperative work.

Student focus and participation. Observers were asked to describe the major way student activities were structured in the elementary science lessons. In 19 percent of the classes, students worked in groups or pairs for the entire or major part of the lesson. In 50 percent of the classes, students worked as a whole group part of the time and in small groups or pairs for the other part of the lesson. In six percent of the classes, students worked individually with individual teacher help for the entire lesson. In 12 percent of the classes, students worked as a whole group then worked individually. One class had students working independently for part of the lesson, then in pairs.

- Students worked independently, then in small groups, and finally came together as a whole group for discussion.
- The students were grouped in pairs, although about two thirds of the pairs seemed to work as individuals during the hands-on discovery.
- There was a variety. Whole group discussion for brainstorming, small group activity along with whole group questioning to check for understanding, small group activity again, working with their partners.

Other observations were made which described the extent to which the students participated in the lesson. Eighty-one percent of the classes exhibited students who were engaged and actively involved in the lesson all or most of the time. One observer noted that the children were involved for half the class and showed disinterest or non-engagement for the other half. The teachers did most of the talking during 38 percent of the lessons, students were observed doing most of the talking in 19 percent, and the teacher and children shared equally in talking during 57 percent. Evidence of participation was not recorded for the other classes.

- The students were examining properties using their senses and sharing their observations.
- The teacher did most of the talking. Students were allowed to answer questions, but not given the time to share other comments.

Connections to student's lives, to other subjects, and to careers. Some evidence of connections to the students' lives was observed in 100 percent of the classes. Some of these connections provided meaningful context to the children while others only offered minimal links to their lives. Connections included:

food
animals
weather
wheels
clothing
shopping
diseases
toys
healthy lifestyle
laundry
home experiences/items

Teachers and students made connections with other subjects in 47 percent of the classes. These included mathematics, language arts, writing, social studies, history, and art.

Sixty-seven percent of the lessons had no observable career connections. Careers mentioned in the other 33 percent of the lessons included scientists, farmers, gardeners, and inventors. One observer noted cultural connections in one of the classrooms.

- The teacher commented that the reason to study fat content is that for a healthy diet, some fat is good, some fat is bad.

- During a lesson about measurement systems: What units does the doctor use to measure your height? What unit is used in road signs?
- They talked about buying vegetables at the grocery store and how farmers grew them.
- Connected evaporation with wet laundry drying outside on a windy, sunny day and in a clothes dryer.

Assessment techniques. Observers were asked to comment on the strategies teachers used during the elementary science lesson to gauge student understanding. Some teachers used a variety of different assessments during a lesson. In 95 percent of the lessons observed, teachers assessed by asking students questions. Students wrote in journals or had some other written assignment in 13 percent and the students were assessed by their experimental set-up or end product in 13 percent. In 7 percent of the lessons, students were assessed by their completion of worksheets or lab sheets. In 20 percent of the lessons, students gave oral reports with the group as an assessment.

- The teacher was continuously posing questions to the whole class. The students used their science journals.
- Posing questions to small groups during oral presentations, individual questions to check for understanding, and posing questions as experiments were being undertaken. After completion of the experiment, students were asked to explain the results of their experiments.
- No assessments that I could see outside of evaluating information in their reports.
- Students had to create, through exploration and discovery, a vehicle that will move.
- The teacher probed to find out prior knowledge of the students.

MIDDLE SCHOOL MATHEMATICS

A total of 12 observations of mathematics lessons were made at six middle schools and one K-8 school. The distribution of various grade levels is shown below.

Class	Number of Observations
Grade 6	1
Grade 7	3
Grade 7/8	1
Grade 8	6
Not reported	1

Learning Environment

Tools and materials used by teachers and students. Besides paper and pencils, students were observed using various manipulatives in 8 percent of the middle school mathematics classes. Students used calculators in 17 percent of the classes, textbooks in 8 percent of the classes, and worksheets in 17 percent of the classes. In 33 percent of the classes, students used paper and pencil only. Other tools used by the middle school mathematics students were measuring tools (17 percent) and an overhead projector (17 percent). Observers reported 42 percent of the teachers used an overhead projector. No other additional tools were used by the teachers.

Seating arrangement and adequacy of space and furniture. Students sat at desks or tables arranged in groups in 33 percent of the classes, in rows of desks in 33 percent, and in pairs at desks or tables in 17 percent. In 58 percent of the classrooms, observers reported excellent to adequate space and furnishings.

- A large room with plenty of space to arrange the tables.
- Rows of desks are well-spaced facing the front. Students are free to arrange the desks for small groups.
- Some rows were squeezed together. It appears as if the students are sitting on top of each other.
- Students were all over, working at tables and on the floor.

Equity in grouping, student interactions, and teacher/student interactions. Observations were made of the diversity of student seating arrangements and pair or group membership in terms of race/ethnicity and gender. Students were seated to reflect a mix of gender in 75 percent of the classes and were arranged to reflect a racial mix in 50 percent. In 25 percent of the classes, student groupings were composed of same-race students.

Teachers interacted and called upon all students equally in all of the classes. One observer failed to report this item.

- She is waking around constantly and talking to each individual, checking each one's work and commenting.
- Students called upon reflected the diversity of the class.
- Teacher posed the majority of her questions to all students, however, only a few would respond on a consistent basis.

Instruction and Assessment

Student engagement, tasks, and activities. As the middle school mathematics lessons unfolded, observers recorded the different tasks and activities in which the students were engaged. Students worked in small groups on collaborative tasks at some point during the lesson in 42 percent of the lessons. Students demonstrated their understanding to the whole class in 58 percent of the classes. Seventy-five percent of the lessons showed at one time or another students practicing routine computations, and 33 percent of the lessons involved students in solving open-ended problems with students explaining different ways to arrive at the same solution. Forty-two percent of the observations reported that students were engaged in higher order thinking skills at some time during the lessons.

- Students were measuring body parts, transferring the measurements to a worksheet. When the worksheet was complete with half the size measurements, they did the scale drawing on large sheets of paper.
- They recorded their pulses before and after running and recorded information from the entire group on their papers.
- Students were filling in charts in their notebooks.
- Students were graphing coordinates and determining slopes and then translating story problems to coordinate axes.
- They started out working on the practice problems. Then they answered orally the steps they took to solve the problems. After that they responded to the questions concerning measuring. Then one student drew on the board the various measuring containers.
- Listened to the teacher's direct instruction, wrote on individual worksheets, asked questions, and answered questions.
- Doing exercises in their notebooks.
- The students copied onto their papers what the teacher did to each problem to solve it. One student answered most of the teacher's questions. Many other students didn't seem to have a clue about what was going on. I, myself, did not understand the concept either, however, I was able to solve and write down all the equations correctly as the teacher had done on the board without understanding what I was doing. While students were doing their homework assignment, no one asked for help.
- Students were creating their own math games independently at their own speed and level.
- Students were watching the teacher and volunteering answers.

Instructional techniques and teacher tasks and activities. Teachers used various techniques during their mathematics lessons and engaged in more than one activity as their lessons evolved. Teachers engaged in the following tasks during the lessons: checking student progress, helping students, encouraging students, asking questions, giving instruction, demonstrating or explaining a concept, guiding group discussion, reviewing homework, lecturing, answering questions, and checking behavior problems. Of these activities, asking questions and demonstrating or explaining a concept were most utilized by the teachers.

- The teacher talked about the homework assignments that needed to be turned in. Then he explained graphing negative numbers, using illustrations on the board. He asked what < and > means, no one answered. Then he explained the symbols and drew the graph on the board.
- The teacher demonstrated on the overhead and worked some problems with the students giving answers. They told her the steps to use.
- The teacher conducted a homework review asking the students "What did we do next?" The students provided answers while the teacher wrote on the chalkboard. Every so often he asked, "Why did you say that?" Otherwise, he accepted answers with no explanation.

Student focus and participation. Observers were asked to describe the major way student activities were structured during the middle school mathematics lessons. Students worked in groups or pairs for the entire or major part of 25 percent of the lessons. Students worked as a whole group part of the time and in small groups or pairs for the other part of 11 percent of the lessons. Students worked individually, with individual teacher help for the entire lesson in 25 percent of the classes. Students worked as a whole group then worked individually in 8 percent of the lessons. Students worked as a whole group the entire lesson in 25 percent of the classes.

- Students were generally working in pairs for measurement and then individually on drawings.
- Individual work, based on teacher guidance, including beginning homework.
- Whole group instruction occurred 100% of the time.
- Worked individually in workbooks.

Other observations were made which described the extent to which the students participated in the lesson. In 33 percent of the classes, students were engaged and actively involved in the lesson all or most of the time. In 8 percent, students were not engaged most of the time. In 42 percent, students were reported as engaged about half the time. Evidence of participation was not recorded by observers for two of the classes.

- All were actively involved.
- 85-90% of the students remained attentive and interested in the lesson.
- Most of the students were interested and involved. Several seemed lost and confused about the concept. A few held off-task conversations while working on their new problems.

Connections to student's lives, to other subjects, and to careers. Real-world connections were made to the students' lives in 67 percent of the middle school mathematics classes observed. These connections included coupons, sale items, cooking, owing money, temperature, metric system, the human body, and creating their own data. Thirty-three percent of the lessons made no connections to the students' lives.

- The lesson was based on shopping for things the students might actually buy, such as tennis shoes and T-shirts. They talked about shopping for deals.
- When she explained the measuring lesson, she used the example of cooking at home.
- The teacher referred to owing money and temperature when describing negative numbers. Used concrete objects to refer to variables and numerals.

None of the lessons had any observable career connections. One teacher talked about other cultures in reference to the metric system. Students were asked how a Canadian would adapt to the non-metric system used by the United States. In 75 percent of the lessons, no connections were made to other subjects. The other 25 percent of lessons made connections to reading, writing, physiology, and home economics.

Assessment techniques. Observers were asked to comment on what strategies teachers used during the mathematics lessons to gauge students' understanding. While all of the lessons observed had questions posed to students, 58 percent of the teachers clearly used the questions as an assessment strategy. In 33 percent of the lessons, worksheets or homework assignments were used for assessment. One group of students was asked to do a self-assessment.

- Posing questions at random to individual students.
- He asked the whole class the questions. A small number of students responded. A few took the chance to answer, were wrong, and didn't volunteer again.
- The teacher had the students create their own game boards and told them they will eventually use a rubric to self-assess their game board activity.

MIDDLE SCHOOL SCIENCE

A total of 13 observations of science were made at seven middle schools. The distribution of various grade levels in shown below.

Class	Number of Observations
Grade 6	2
Grade 7	5
Grade 6/7	1
Grade 8	4
Not grade reported	1

Learning Environment

Tools and materials used by teachers and students. Availability and use of tools, technology, materials, and equipment varied widely in the middle school science classrooms. Fifty-four percent of the classes used various science tools, materials, and equipment including beakers, soil, seeds, aquarium, worms, magnifying glasses, flashlights, dowels, string, petri dishes, and more. Students used calculators in 15 percent of the classes, measuring devices in 38 percent, cameras in one class, and textbooks in 23 percent. One class used paper and texts only during the entire lesson. Once teacher made use of a stop-watch and another had an animal specimen. Other teacher materials included the chalkboard, charts, and a meter stick.

Seating arrangement and adequacy of space and furniture. Middle school science students were seated in groups in 69 percent of the classes, in pairs in 23 percent, and in rows in 8 percent. Seven observers rated the furnishings and space provided for the students and teachers as adequate to excellent. One observer felt a classroom was extremely overcrowded due to the large number of students as 50 students from two classes were combined for team-teaching. One observer did not report on this item. The following are examples as stated by the observers.

- This is a large room with ample space for the students.
- There are enough tables adequate to work either in groups or alone.
- Plenty of room, very comfortable.
- The desks are at one end of the room so free space could be used for the experiments.

Equity in grouping, student interactions, and teacher/student interactions. Observations of seating arrangements revealed that 38 percent of the science classes at the middle school level exhibited diversity in the seating and grouping arrangements of students with regard to both gender and ethnicity/race. In 62 percent of the classes, students were grouped showing evidence of segregation by gender as well as ethnicity and race. In 92 percent of the classes, teachers engaged, encouraged, and interacted with all students regardless of ethnicity, race, or gender. One observer reported that in one class, the girls were chosen and the boys were reprimanded.

- The students are fairly balanced racially and ethnically, but very lopsided males to females.
- Girls sat with girls, boys with boys.
- Generally, the pairs of students were of the same gender/race, however some were diverse.
- The teacher moved quickly from table to table, giving help where needed. She let the students decide who would do which tasks. The students are well behaved and very much at ease and comfortable in this room.
- Boys were disciplined and reminded for inappropriate behaviors and the girls were called on to read and play "teacher." One girl was asked to write on the chalkboard.
- Lots of energetic small group interaction within the context of individual work on their projects.
- The teacher helped all the tables/groups, talking the same way to all, quietly and non-judgementally.
- The teacher encouraged boys to call on girls for the next trial.

Instruction and Assessment

Student engagement, tasks, and activities. As the middle school science lessons evolved, observers recorded the different tasks and activities in which the students were engaged. Students worked in small groups on collaborative tasks at some point during the lesson in 85 percent of the observed classes. Students demonstrated their understanding to the whole class in eight percent of the classes. In 38 percent of the lessons, students were engaged in solving open-ended problems.

In eight percent of the observations, students were engaged in higher order thinking skills. None of the classes observed showed students posing questions or problems for other students to answer or solve. Observers reported that in 85 percent of the lessons, students conducted a structured demonstration of a scientific phenomena or concept, while in 15 percent of the lessons, students created their own plan to investigate a scientific question or problem.

The following is a list of activities, skills, and tasks recorded by observers in which the students were engaged:

structured experiment
constructing a model
getting supplies
answering questions
writing reports
copying lab assignment
calculating data
reading from the text
testing
listening to the teacher
working on projects
observing
filling out lab or work sheet
art work
problem solving
constructing a data sheet
reviewing homework
writing conclusions

The following are examples as stated by the observers.

- The students were sitting in groups of three to four around tables, working in groups but filling out individual papers.
- The students were learning to measure and calculate work and power. They had to run stairs and get a time. Three students assisted the teacher in monitoring for rule-breaking (skipping steps, touching the rail, etc.). Back in the room they calculated their work output, power, and time.
- Students were beginning to create Earth Day posters for a poster contest.
- The students were engineering a balanced mobile. They got supplies (dowels, strings, weights, etc.), determined balance points, constructed the mobiles, and corrected errors after trials.
- Students answered teacher directed questions, listened or read the worksheet, did the worksheet, and directed the review of the worksheet.
- The students constructed a data sheet as directed. They needed to build a cardboard regatta-skimmer of folded paper. Put together a baster/balloon contraption to move the skimmer. They measured the distance the skimmer moved based on the baster/balloon contraption and on their lung power from a straw. They averaged three trials of distance moved and recorded the information on the data sheets.
- The students wrote their lab assignments from the board into their journals.
- The students and teacher went over their homework papers. They copied their lab assignment from the overhead and made observations and measurements of specimens. They copied another lab assignment and made more observations.
- No students finished the measuring (inches on a worksheet). Some tried, most gave up. By the end of the lesson, only a few students had even made an attempt at measuring. Most had nothing on their papers and were completely off task.

Instructional techniques and teacher tasks and activities. Teachers used various techniques during their lessons and became engaged in more than one activity as their lessons evolved. The instructional techniques observed the most by teachers were handing out supplies and materials, helping and encouraging students as they worked, and lecturing or giving information. Other teacher techniques, tasks, and activities observed were:

reviewing homework
answering questions
asking questions
explaining an activity
demonstrating
disciplining students
checking student progress
reading information

When observers were asked who did the most talking during the lesson, they reported that in 38 percent of the lessons teachers did the most talking, in eight percent the students did most of the talking, and in 30 percent teachers and students shared equally the time talking. One observer did not report on this item.

- The teacher was lecturing, questioning, encouraging student participation. When the students broke up into groups at lab tables, the teacher visited with different groups, observed, questioned, explained, and answered questions.
- Once the teacher had explained the experiment, she stood on the sidelines and encouraged students, corrected the details of the experiment, kept order in the class, and asked them to speed it up.
- Both teachers were handing out materials and trying to maintain order in the room by having students sit with their groups, not walking around the room.
- Part I: The teacher was asking recall questions and giving information about the topic. Part II: Talking to individual students or pairs or giving more information to the whole class. Part III: Introduced another lab with more information. During the lab, students talked freely with each other while observing and taking measurements. However, this was brief. The teacher did most of the talking throughout the lesson, mostly giving information.
- The teacher did most of the talking—giving instructions and questioning past knowledge as it related to the subject of the day.
- The students did most of the talking as they interacted with other students in their groups.
- The teacher did most of the talking, to emphasize procedures. Students talked only to read and respond to answers, yet one group had specific conversations within the group about the procedures and data collection of the activity.
- The teacher was lecturing, reading information to the students, reviewing information, and posing questions while searching for materials for the lesson.

Student focus and participation. Observers were asked to describe the major way student activities were structured during the middle school science lessons. Students worked in groups or pairs the entire or major part of the lesson in 31 percent of the classes. Students worked as a whole group part of the time and in small groups or pairs for the other part of the lesson in 15 percent. Students worked individually with individual teacher help for the entire lesson in 15 percent. Students worked as individuals part of the time and in small groups or pairs the rest of the time in 15 percent of the lessons. In another 15 percent of the observed classes, students worked for the entire class period as a whole group. One observer did not report for this item.

Observers reported that in 62 percent of the lessons, student groups were activity participating and engaged during most or all of the lesson. Students were not engaged for much of the lesson in 23 percent of the classes and were engaged about half the time in 8 percent of the classes. One observer did not report on this item.

- After 45 minutes, the students were still on task and involved making models and reading from their texts.
- They asked questions when necessary and worked eagerly on their projects.
- The students were initially off task, but after they got their materials, they got on task and answered the questions. They seemed to enjoy sharing their findings with other groups.
- They were all actively involved in their work on their science fair projects. They also walked around and talked to other groups about their projects. The students were very willing to talk about what they were doing and how they did their work.
- Students seemed very interested in the activity but they did not really participate in the content of this lesson as it was very teacher directed and there were no real interactions regarding content, more-so just directions related to the material distribution and the writing of the information from the board into their journals.
- Some students in the back were not paying much attention to the opening review questions and information. They became more interested when the teacher talked and worked with them as a small group.
- A few students volunteered for the initial whole group discussion. Most of the time the students chatted with their friends about things other than their task.
- The students seemed enthusiastic and worked well even when the teacher was not in the room. They volunteered answers to questions to the class.

- The students responded to questions when called on. They demonstrated their work from their lab sheets. The interest seemed to remain to the end of the class.
- Students were very involved when left to explore the construction of their own designs.

Connections to student's lives, to other subjects, and to careers. It was reported by 39 percent of the observers that no connections were made to the students' lives during the middle school science lessons. In 61 percent of the lessons, at least one connection to students' lives occurred: a healthy lifestyle, diseases, the human body, the natural environment, art, and weather disasters. In 77 percent of the lessons, no connections were made to other subjects. In the other 23 percent connections were made to writing and mathematics. No cultural or career connections were observed.

- They used graphing in the science class.
- Their projects related to things of interest in their lives: drugs affecting unborn babies, tornadoes, plants, trains.
- The teacher spoke of the need to create and use land for landfills sites. The teacher spoke of how we produce lots of garbage, how this garbage keeps filling landfills, how landfill space is running out, and how we need to reduce the amount of garbage we produce.

Assessment techniques. Observers were asked to comment on the assessment strategies used during the science lessons to gauge student understanding. Forms of assessment used by teachers in the middle school science classes were asking questions (31 percent), the production of and end product or experimental design by the students (31 percent), and worksheet completion or lab report (46 percent). Other forms of assessment were journal writing, a quiz, oral sharing with whole class, and teacher observation.

- The teacher checked over students' worksheets as they were writing.
- The teacher was posing questions to the whole class, individuals, and groups. There was open discussion and writing as well as a quiz.
- The students' journal assignment and concept-web activity for homework was clearly an assessment as the students needed to analyze the concepts and write about the lesson content.
- Mostly whole group questions that were almost entirely recall questions. A few open-ended questions. Students wrote and illustrated in their lab notebooks or on paper. There were homework papers. Many students did not answer any oral questions.
- Trying to help the students individually must have led the teacher to the understanding that these kids needed lots of help in basic measurement skills.
- No assessment besides answering the worksheet questions aloud in class and reading the procedures aloud to clarify the directions for the activity.
- Questioning students as they worked on problems on the worksheet.
- Assessment focused on "Did the mobiles the students had constructed work?" The teacher asked open-ended questions. Even the art worksheet had quantitative data indicated such as mass, force, distance, work.
- The teacher asked factual questions to check for understanding of short passages from the text.
- The worksheet was collected at the end of the class.

HIGH SCHOOL MATHEMATICS

A total of six observations of mathematics were made at three high schools. The distribution of various grade levels and math subjects is shown below.

Class	Number of Observations
Grade 9 Algebra	4
Grade 11 Geometry	1
Grade 12 Pre-calculus	1

Learning Environment

Tools and materials used by teachers and students. Little variety occurred in the tools and materials the students were using in the six high school mathematics classes. Students used calculators in 67 percent of the classes, some of them graphing calculators. Students used computers in 33 percent of the classes and used only paper and pencils in 17 percent. The following are examples as stated the observers.

- One computer crashed during class and would not reboot. The class is hindered by the old computers that cannot handle the math software. The class has 27 computers, but only nine are working with the software.
- This class is advanced mathematics precalculus with a discrete mathematics and data analysis text.

Teachers in these classes used the chalkboard in half of the observations. One teacher used a computer and overhead projector, one teacher used an overhead with algebra gear, and one teacher used no tools.

Seating arrangement and adequacy of space and furniture. The observations revealed that 76 percent of the high school mathematics classrooms had students sitting in rows. The other 33 percent of observations noted students seated in various groupings. All observers reported that the space and furniture in the classrooms were adequate for the lessons.

Equity in grouping, student interactions, and teacher/student interactions. Evidence of inequity was noted by observers for both racial/ethnic grouping and gender grouping. Students were seated in same gender and same race groups in 67 percent of the classes. Teacher-student interactions were equitable in all observed classrooms. The following are examples as stated by the observers.

- The majority of students in the pre-calculus class of 17 students was female with nine African American students and eight Caucasian students.
- Girls are grouped with girls, boys are grouped with boys, except for the one white female student who is with two males. All the other students are Asian American.
- This class has a tremendous amount of males in it (16 males, 2 females, 11 African American students, 7 Caucasian students).
- The majority of the class were females (13 out of 17).

Instruction and Assessment

Student engagement, tasks, and activities. As the high school mathematics lessons unfolded, observers recorded the different tasks and activities in which the students were engaged. In 50 percent of the classes, students worked in small groups on collaborative tasks at some point during the lesson. Students demonstrated their understanding to the whole class in 16 percent of the classes. In 83 percent of the lessons showed, at one time or another, students practiced routine computations. In 33 percent of the lessons, students were engaged in solving open-ended problems. No students were observed posing questions or problems for other students to answer or solve. Students worked on worksheets solving problems in two classes, worked the entire class time on computers solving problems in two other classes, and solved problems using calculators in the remaining two classes.

- The PUMP program is individualized. Students are completing Algebra lessons on each computer.
- Students were working on their problems at their desks in groups.
- The students were responding to students' questions and working with graphing calculators.
- Students worked on the problems on their worksheets after the lesson was presented.
- Students were asked to solve an equation and graph. Then they were given another equation to solve, this time with the calculator.

Instructional techniques and teacher tasks and activities. Observers found little variety in the teachers' instructional tasks and activities among the high school mathematics lessons. Most spent time in class checking work and helping students with problems. Two teachers used the chalkboard exclusively to demonstrate how to solve problems, instructions, or record homework assignments. One teacher used an overhead projector with Algebra gear.

- The teacher had to explain many words in English because this was an ESL math class.
- The teacher was walking around helping those students who needed extra help. Also encouraged students to help each other.
- Writing on the chalkboard.

Student focus and participation. Observers were asked to describe the major way student activities were structured in the high school mathematics lessons. Four of the six classrooms observed had students working individually the entire class period. One lesson had students working as a whole group for part of the lesson and in small groups for the rest of the lesson. The students in the other class worked together as a whole group with the teacher for the entire class period.

Four classes of students stayed on task and were involved and remained interested in the lesson. One observer noted that students had problems staying on task for 49 minutes in the computer room. One observer failed to note this item.

Observers reported that in three classes the teachers did most of the talking. In two of the classes the students did most of the talking.

- Students began working on their lessons on the computers. There was no discussion about where to begin on the program. Each student was already programmed to begin immediately on his or her lesson. Lessons varied from student to student.
- The teacher lectured while students listened. Most students did not write down any notes.
- Half the time the teacher talked the most. The other half, the students talked. Toward the end of the class the students were working independently.

Connections to student's lives, to other subjects, and to careers. Few connections to the students lives and the real world were made in these high school mathematics classes. Sixty-seven percent of the lessons exhibited no connections and thirty-three percent made connections to technology and through story problems. Sixty-seven percent of the lessons made no connections to other subjects. One lesson made a connection to science. No career connections or connections to cultures were observed.

Assessment techniques. Observers were asked to comment on the strategies teachers used during the mathematics lessons to gauge students' understanding. Some teachers used a variety of different assessments during a lesson while others relied on one form of assessment. Most teachers asked questions of the students. One teacher observed the work the students were doing, one teacher assigned a worksheet, one gave instructions for a self assessment, one announced a quiz, and two teachers relied on computer programs to assess how far along the students had gotten.

- The computer program automatically assesses students' progress and promotes students when appropriate.
- At the beginning of the class, the teacher gave instructions for a self-assessment assignment for their portfolio. The instructions were on how to organize it.
- The teacher goes around the room checking the work the students are doing on graphing calculators. Checks back until they have it right.
- The teacher can students by the number of lessons they have completed on the computer program.
- Students worked on practice problems and then checked one-on-one with the teacher.
- There was a lot of interaction going back and forth. Students were asking questions to clarify and the teacher was also posing questions.

HIGH SCHOOL SCIENCE

A total of nine observations of science classes were made at four high schools. The distribution of various grade levels is shown below.

Class	Number of Observations
Grade 9	5
Grade 10/11	1
Grade 11	2
Grade not reported	1

Learning Environment

Tools and materials used by teachers and students. Students in 56 percent of the observed high school science classrooms worked with a variety of materials, tools, and equipment. These materials included such items as washers, mirrors, overhead projectors, safety glasses, beakers, test tubes, chemicals, eye droppers, wires, batteries, worksheets, connectors, stop watches, pill bugs, and stereo microscopes. Students used no tools or equipment in 11 percent of the lessons, used measuring tools in 11 percent, and used paper and pencil only in another 11 percent. Teacher materials used were overhead projector, pendulum, transistors, resistors, and photo cells.

Seating arrangement and adequacy of space and furniture. High school science students were arranged in groups in 11 percent of the classes. They sat in rows in 56 percent and in pairs in 33 percent. Seventy-eight percent of the observers reported adequate to excellent furniture and space provided for the students and teachers. One classroom was rated as okay and one other was rated as not adequate.

- The room is not conducive to group work, but desks could easily be moved if necessary.
- There are enough desks, enough lab space.
- There is an adequate amount of rows and seats, with a lab area towards the back.

Equity in grouping, student interactions, and teacher/student interactions. The ethnicity/race distribution of the students in the observed science classes reflected the diversity of the students in the school. Observations were made of the diversity of seating arrangement and group membership in terms of race/ethnicity and gender. Thirty-three percent of the classes observed had well-mixed groups by gender and 55 percent had same gender groups. Twenty-two percent of the classes had mixed racial/ethnic groups and 33 percent were segregated by race. The remaining observers did not report on this item as entire classes were African American or Hispanic or primarily female.

- Students got into groups on their own—males sat with males, females with females.
- The majority of the class is females. Three African Americans decided to work in a group, two whites decided to work in a group. The rest decided to work alone.
- Students worked individually in separate rows. Hispanic students talked to each other. The only African American did not talk to anyone.
- The class is predominately African American females whom the teacher feels will not be scientists, but will go on to MATC.
- All the boys (only 4) are grouped together in the experiments as well as at their desks for general class discussion. Female groupings are well integrated by race/ethnicity.

All interactions between the teachers and the students were equitable with the teachers seeming to equally engage, encourage, and interact with all students regardless of gender/ethnicity/race.

- Very much. Students respond readily in a relaxed and secure and respectful manner. Students seem to like this teacher.
- Diverse student responses and engagement. All seemed eager and anxious.
- Walked around and helped the students. Also encouraged those that were not understanding the lab.

Instruction and Assessment

Student engagement, tasks, and activities. Students engaged in a variety of tasks and activities as the high school science lessons evolved. In 67 percent of the classes, students worked in small groups on collaborative tasks at some point during the lesson. Students demonstrated their understanding to the whole class in 11 percent of the classes. Thirty-three percent of the lessons involved students engaged in solving open-ended problems.

Sixty-seven percent of the observations reported students engaged in higher order thinking skills. Twenty-two percent of classes showed students posing questions or problems for other students to answer or solve. In 44 percent of the lessons, students conducted a structured demonstration of a scientific phenomena or concept. In 11 percent of the lessons, students created their own plan to investigate a scientific question or problem.

The activity observed the most in the high school science classes was students engaged in lab work. The following is a list of other activities, skills, and tasks recorded by observers in which the students were engaged at some time during the lesson:

taking a test
copying overhead into notebooks
completing a worksheet
asking questions
reviewing for a quiz
reading and answering quiz questions

The following are examples as stated by the observers.

- The students worked on integrated circuits. They worked to construct the three types of integrated circuits: resistor, photocell, potent iometers.
- Each student group had test tubes of different colored liquids, like those used by the teacher. The students were performing tests, discussing among themselves, referring to worksheets, and recording results.
- The students are completing a worksheet.

Instructional techniques and teacher tasks and activities. Teachers used various techniques during their science lessons. The instructional technique observed the most was teachers helping and encouraging students as they worked. Other teacher techniques, tasks, and activities observed were:

lecturing, giving explanations, and examples
calling on individual students
asking for assignments
showing overheads
reviewing lesson material
demonstrating

The following are examples as written by the observers.

- The teacher explained the information for the quiz, got materials ready for the students to do the lab, then walked around to help, encouraging, and keeping students on task.
- The teacher was asking for assignments that had not been turned in because the marking period closes tomorrow.
- When the groups went to the lab tables, the teacher was moving in and out of groups repeating instructions and answering questions.
- The teacher walked around to each group, questioned students about their procedures and findings, gave encouragement and positive feedback from their work, talked at their level, and talked about other areas of interest to certain groups. For example, New Mexico came up and he talked about that state with one group for awhile.

Student focus and participation. Observers were asked to describe the major way student activities were structured during the science lessons. In 56 percent of the classes, students worked as a whole group with the teacher throughout the entire lesson. In 49 percent, students worked at first individually or in a whole group and then worked in small groups.

Other observations were made which described the extent to which the students participated in the lesson. Five of the nine observers reported that the students were well engaged and on task during all or most of the lessons. The students in two classes were reported as somewhat engaged and one class was reported as not engaged or on task during most of the lesson.

When asked to comment on who did most of the talking during the lessons, four observers reported the teacher doing most of the talking, four observers reported that talking and discussion was shared equally by the students and the teachers, and one observer noted that the students did most of the talking during the lesson.

- They sat in rows at first, then got into groups, some just paired up and others formed groups of three.
- The students answered questions, followed directions from the lab worksheet, and got help from the teacher.

- Most students worked with each other. The students that worked alone would shout out when they were excited for the teacher to see their experiment.
- At first the teachers talked for the review and the quiz. Then the students talked when they were in the lab. They stayed on task.
- The students read questions and answers for the quiz review. All seemed interested. All were taking notes.
- The students listened to the teacher. Two had their head down on their desks for a time at the beginning. Students didn't volunteer much. They worked on their class assignment.
- The lesson was teacher directed.
- At the start the teacher did most of the talking with the students answering his questions. Then in the lab, the students talked mostly, but the teacher still moved around and talked to each group.

Connections to students' lives, to other subjects, and to careers. Fifty-six percent of the high school science lessons made connections to students' lives. The connections included healthy lifestyle, items from the home, diseases, and balancing a checkbook. The other 44 percent of the high school science classes made no connections to the students' lives. No connections to other subjects were made in 67 percent of the classes. Connections that were made to other subjects included writing and mathematics. Eleven percent of the lessons included career connections to the work of scientists. No cultural connections were observed.

- At the start of the class, the teacher asked for examples of stress on something: the start of exams, buying a new car, the economy were examples given.
- No connections that I could tell.
- Discussed how mutations are related to diseases and tumors. The kids asked lots of specific questions, e.g., how could a person who smoked, then quit, get cancer several years later? Nearly all the students questions were about how this information relates to their health, thinking of people or situations they know. They got very concerned about asbestos in the school when they asked what it does. The teacher talked about how paternity testing is done.
- The teacher talked about importance of education after high school.
- The teacher did say that the life of a scientist includes collecting data through observations.
- Connections to math: perpendicular lines, angles, and formulas.

Assessment techniques. Observers were asked to comment on strategies used by the teacher to gauge students' understanding during the high school science lessons. Twenty-nine percent of the teachers assessed their students by asking questions, 33 percent assessed through observation, 11 percent assessed with a worksheet, and 33 percent assessed their students with a quiz.

- The teacher was posing questions to the entire class, calling on specific students. Walked around while students were working and asked questions and looked over their work.
- The teacher returned a quiz and went through it with the students. One side of the quiz was matching with emphasis on vocabulary. The other side had two questions asking student to make punnet squares and genotypic ratios. A bulletin board stated: Attendance 20%, tests 20%, notes 20%, labs 15%, folders 10%.
- The teacher questioned the entire class at first. Then she gave the quiz, which questioned them individually. Then she questioned them through the lab, going to each group, and then to individuals with questions and encouragement.
- Open-ended questions, pose to small groups or one-on-one. Direct observations. Students wrote formulas on the lab sheets that were provided by the teacher. The lab sheets were collected at the end of the hour.

SUMMARY

Observations of mathematics and science classrooms in First Wave MUSI schools provided a snapshot of teaching and learning as MUSI embarked on its first year of implementation. Varied instructional practices and student learning opportunities in mathematics and science were observed during site visits to a sample of 18 First Wave MUSI schools. A total of 74 classrooms were observed; 34 elementary classrooms, 25 middle school classrooms, and 15 high school classrooms. Of these 74 observations, 36 were of science lessons and 38 were of mathematics lessons. The major findings are highlighted and displayed below.

Student and Teacher Tools and Materials

The results for student and teacher use of tools, materials, and technology is displayed in Table 1. Teachers and students used computers in only two out of 74 mathematics or science classes. Calculators were primarily used by high school mathematics students. Of all the science classrooms observed, calculators were used in only four middle school classes.

Almost all elementary science and mathematics students used a wide variety of mathematics manipulatives, science equipment, and other materials. One middle school class and no high school classes used mathematics manipulatives. A little over half of the high school science classes used science equipment and materials other than textbooks and paper.

Table 1. Tools, Materials, and Technology (Percent of Lessons Observed)

	Mathematics			Science		
	Elementary	**Middle**	**High**	**Elementary**	**Middle**	**High**
Student Tools						
Variety of materials	89	8	0	93	54	56
Chalkboard	33	0	0	0	0	0
Overhead	0	17	33	0	0	0
Calculators	11	17	67	0	38	0
Computer	0	0	17	0	0	0
Measuring tools	16	17	0	0	23	0
Worksheets & lab reports	16	17	0	35	0	0
Paper and pencil only	5	33	0	0	0	11
Textbook	5	8	0	6	8	0
None	0	0	0	7	15	11
Teacher Tools						
Materials, equipment	26	0	0	13	15	29
Chalkboard	21	0	50	27	8	0
Overhead	32	42	17	13	0	11
Computer & overhead	0	0	17	0	0	0
Laser disc	0	0	0	7	0	0
Charts	0	0	0	13	8	0
Textbook	0	0	0	0	8	0
None	31	58	17	33	62	60

Student Grouping Arrangements and Equity

Table 2 displays the results for student grouping arrangements and the equity of student groupings and teacher/student interactions. The majority of high school mathematics and science students worked independently with desks arranged in rows, while the majority of elementary and middle school science students worked in groups or pairs. Groupings of students in most elementary and some middle schools were of mixed race, ethnicity, and gender. In comparison, most high school students and over half of the middle school science students when collaborating, worked in same gender and racial groupings. Teachers in all grades called upon all students equally and assisted or encouraged all students equitably.

Table 2. Student Grouping Arrangements and Equity (Percent of Lessons Observed)

	Mathematics			Science		
	Elementary	**Middle**	**High**	**Elementary**	**Middle**	**High**
Seating Arrangements						
Groups	53	33	33	67	69	11
Rows	26	33	67	0	8	56
Pairs	10	17	0	20	23	33
Whole group	10	8	0	13	0	0

Table 2 (continued). Student Grouping Arrangements and Equity (Percent of Lessons Observed)

	Mathematics			Science		
	Elementary	**Middle**	**High**	**Elementary**	**Middle**	**High**
Equity Student Groups						
Mixed gender	84	75	17	56	38	33
Same gender	16	25	67	38	62	55
Mixed race/ethnicity	79	50	17	56	38	22
Same race/ethnicity	16	25	67	35	62	33
NA	0	25	17	13	0	45
Equity Teacher/Student Interactions						
Yes	95	83	100	94	92	100
No	5	0	0	6	8	
NA	0	17	0	0	0	0
Adequate to excellent furnishing and space	89	58	100	81	58	78

Student Engagement, Tasks, and Activities

Elementary and middle school science students were engaged in a far greater variety of skills and tasks than mathematics students. See Table 3. Most mathematics and science lessons allowed students to work together on collaborative tasks.

Observers recorded that teachers posed open-ended questions more often in science than in mathematics lessons. Elementary students engaged in solving more open-ended problems in mathematics and science than middle and high school students. Fifty-five percent of the elementary students, 75 percent of the middle school students, and 83 percent of the high school students practiced routine computations or algebraic manipulations.

While engaged in hands-on activities, science students at all grade levels participated in more structured, teacher-directed demonstrations than in student planned investigations. This was particularly evident at the middle school level.

Table 3. Student Engagement, Tasks, and Activities (Percent of Lessons Observed)

	Mathematics			Science		
	Elementary	**Middle**	**High**	**Elementary**	**Middle**	**High**
Open-ended problems	55	33	33	50	38	33
Demonstrate understanding to class	55	58	0	25	8	11
High-order thinking	40	42	67	69	8	67
Posing questions	22	17	0	22	0	22
Collaborative tasks	33	42	0	63	85	67
Structured demonstration	0	0	0	69	85	44
Student planned investigation	0	0	0	44	15	11

Connections

The results for presence of connections to students' lives, to other subject areas, to careers, and to culture are listed in Table 4. Almost all elementary science lessons and over half of the middle school and high school science lessons exhibited some connections to the children's lives. Over two-thirds of the elementary and middle school mathematics lessons made some kind of connections to the students' lives. Significantly fewer connections were made to the lives of high school mathematics students.

Most mathematics and science lessons at all grade levels made no connections to other subject areas. Career connections, for the most part, were rarely made at any grade levels, especially in mathematics. About one-third of the elementary science classes did exhibit career connections. Only one elementary science class and one middle school mathematics class out of 74 observed made any cultural connections.

Table 4. Connections (Percent of Lessons Observed)

	Mathematics			Science		
	Elementary	**Middle**	**High**	**Elementary**	**Middle**	**High**
Students' lives	68	67	33	100	61	56
Other subjects areas	21	25	17	47	23	33
Careers	21	25	17	33	0	11
Culture	0	8	0	6	0	0

Assessment Strategies

The results for the use of assessment strategies is shown in Table 5. Elementary teachers used a variety of assessments with their students, such as observations, oral sharing, and journals. Most middle and high school teachers assessed their students with questioning, quizzes, work sheets, and lab sheets.

Table 5. Assessment Strategies (Percent of Lessons Observed)

	Mathematics			Science		
	Elementary	**Middle**	**High**	**Elementary**	**Middle**	**High**
None	5	0	0	7	0	0
Asking questions	95	58	50	95	31	29
Writing in journals	10	0	0	13	8	0
Observation	10	0	16	13	0	33
Worksheets or homework	0	33	16	7	46	11
Self assessment	0	8	16	0	0	0
Students demonstration	50	0	0	0	0	0
Tests or quizzes	0	0	16	0	8	33
Computer program	0	0	33	0	0	0
Concept map	0	0	0	0	8	0
Products or designs	0	0	0	13	31	0
Oral sharing with group	0	0	0	20	16	0

APPENDIX A

FIRST WAVE MUSI SCHOOLS

First Wave MUSI Schools

Elementary Schools

Ann F. Doerfler
Auer Avenue
Clarke Street
Clement J. Zablocki
Dr. Martin Luther King, Jr.
Eighty-first Street
Fifty-third Street
Franklin Pierce
Garfield Avenue
Gilbert Stuart
Grantosa Drive
Green Bay Avenue
Henry David Thoreau
Lloyd Street
McNair Academy
Milwaukee Spanish Immersion
Morgandale
Neeskara
River Trail
LaFollette
Sixty-fifth Street
Urban Waldorf
U.S. Grant
Walt Whitman
William Cullen Bryant
William T. Sherman

K–8 Schools

Cass Street
Fernwood
Hartford Avenue

Middle Schools

Gustav A. Fritsche
Christopher Lathom Sholes
Thomas A. Edison
Daniel Webster
Steuben
Jackie Robinson
Lavarnway Boys/Girls Club
Lincoln School of the Arts
Roosevelt School of the Arts
John Burroughs
Sarah Scott
Malcolm X Academy
Andrew Douglas Community Academy
Milwaukee Village
Moltke Academy

Middle/High Schools

Grand Avenue
Milwaukee School of Languages

High Schools

South Division
Solomon Juneau
Casimir Pulaski
Harold S. Vincent
Washington

APPENDIX B

SITE VISIT GUIDE

mps

Milwaukee Public Schools

MUSI

Site Visit Guide

Milwaukee Urban Systemic Initiative (MUSI)

April 1997

Prepared by DeAnn Huinker

Center for Mathematics and Science Education Research
265 Enderis Hall
University of Wisconsin-Milwaukee
Milwaukee, WI 53201-0413
414-229-6646

General Guidelines for Conducting the Site Visit

The purpose of the site visit is (1) to develop an understanding of the science and mathematics programs at the school and (2) to gain an understanding of the impact of MUSI.

The site visit team will consist of four individuals, including school personnel and community representatives. A site visit will include:

- Four classroom observations, two mathematics and two science;
- One student group-interview with six students,
- Two teacher group-interviews with three teachers per interview; and
- A principal interview.

Before the Visit

✓ The team leader will receive a packet of materials that includes:

- School site visit schedule (1 copy)
- Classroom observation guide (4 copies)
- Student group interview protocol (1 copy)
- Teacher group interview protocol (2 copies)
- Principal interview protocol
- 4 audiotapes

✓ The team leader will contact each team member to confirm:

- Arrival time at the site, and
- Responsibilities of each team member.

✓ Each team member should try to obtain an audio tape recorder to use for conducting interviews. The recorder should run on batteries, so you can position it in a way to best capture the responses. You may want to bring along extra batteries. If you do not have access to a tape recorder, contact your team leader so she/he may make arrangements to bring an extra recorder.

Arriving at the Site

✓ Please sign in at the office and acquire visitor badges.

✓ Get schedule, observation guide, interview protocols, and audiotapes from the team leader.

✓ Confirm responsibilities for observations and interviews with other team members.

✓ Confirm room locations for conducting interviews and observations. If time allows, you may want to locate the rooms and tour the school.

During the Site Visit

✓ As one team member conducts a student or teacher group interview, another member should sit in on the interview and take extensive notes. The plan is to use the audiotapes from these interviews as a back-up to clarify the written notes.

✓ One team member will conduct and record the principal interview. The audiotape will be the primary source of data from these interviews.

✓ In general, one person will conduct a classroom observation, but if there is some open time for a site visitor, two team members may want to observe a class together. Just make a note on the observation guide that the class was observed by two people.

✓ Be FLEXIBLE and make changes as needed. If teachers or students are absent, an observation may need to be canceled or quickly scheduled with another teacher or an interview may be conducted with fewer teachers or students than planned. Just make note of any changes on the interview sheets or observation guides.

Conducting Classroom Observations

✓ Introduce yourself to the teacher. Thank her or him for the opportunity to observe the class.

✓ Position yourself towards the back or side of the classroom.

✓ If non-obtrusive, feel free to move about the room during the observation to better hear what students are saying as they work in pairs or small groups or to better see what students are working on or writing.

✓ Record your observations directly on the observation guide. If you need more room to write, you may write on the back of the form or use additional paper.

Conducting Interviews

✓ It is important that the interview room allows for privacy. The door should be closed. You may want to put a sign on the door which states, "Interview in progress, do not disturb."

✓ For group interviews, it is best if all interviewees sit around the same table with the interviewer. This puts each person at the same level. Then the tape recorder can be positioned in the center of the table. If the interviewees are sitting at desks, rearrange them into a circle and find an appropriate place to position the tape recorder.

✓ Check to see that the audiotape recorder is working and record the type of interview, school name, date, and your name at the beginning of the tape. For example, "This is a student interview at Johnson Elementary School. Today is April 17, 1997. The interviewer is (your name)."

✓ As you conduct the interview, simply pose the questions and probe the interviewees when needed to get more responses and more detail. For example:
- Does anyone else have something to add? (with a long pause)
- What do you think?
- Tell me more about that.
- Would you elaborate on that?
- Could you give an example?
- What you are saying is very important. It would help if you would say more about that.

✓ Listen carefully to the responses. You may need to make adjustments in question format or repeat questions based on the characteristics of comments made.
- Shallow responses: Ask them to elaborate.
- Off-target responses: Rephrase the question to focus attention.
- Rambling/unfocused responses: Let me stop you there for a moment.... rephrase question.

✓ In the event that the tape recorder fails at some point during an interview, (1) write notes to capture as much of the interview as possible or (2) attempt to quickly find another tape recorder.

✓ After the interview is over, punch out the two tabs at the back of the audiocassette to prevent it from being accidentally erased. Double check to see that the information written on the tape label is accurate.

After the Site Visit

✓ Give all materials—observation forms, interview protocol sheets, audiotapes—to the team leader who will return them to Linda Turner.

Questions, Concerns, or Problems

Linda Turner or Tracy Posnanski	229-6646 or 229-6277
DeAnn Huinker	229-5467

Guidelines for Being a Team Leader

Prior to the Site Visit

√ You will receive a packet of materials for each school visit that includes:
  - School site visit schedule (4 copies)
  - Classroom observation guide (4 copies)
  - Student group interview protocol (1 copy)
  - Teacher group interview protocol (2 copies)
  - Principal interview protocol
  - 4 audiotapes

√ Contact the site visit school to confirm site visit appointment and arrangements.

√ Contact each team member to confirm:
  - Arrival time at the site.
  - Directions to the school.
  - Assignment of responsibilities for each team member:
    Who will conduct the student interview? teacher interviews? principal interview?
    Is there a preference for observing mathematics or science classes?
  - Availability of tape recorders.

√ Arrange for audiotape recorders for yourself and any team members that may need one. If the schedule allows, you may be able to share one or two tape recorders among the team. Tape recorders can be borrowed from the schools. If you have problems obtaining tape recorders, there are several available at UWM. Contact Linda Turner at 229-6646.

Arriving at the Site

√ Confirm the site visit schedule with the principal.

√ Confirm responsibilities for observations and interviews with other team members.

√ Distribute materials to members: schedules, observation guides, interview protocols, and tapes.

During the Site Visit

√ Be FLEXIBLE and make changes as needed. If time constraints become a problem, attempt to complete activities prioritized as follows: (1) Classroom Observations, (2) Teacher interviews, (3) Student interviews, (4) Principal interviews.

After the Site Visit

√ If any changes occurred to the original site visit schedule, please make note of them on the schedule. One copy of the schedule should be returned along with the other materials.

√ Check to see that all audiotapes are labeled properly.

√ Collect all the materials from your team:

√ Return all materials to:

Linda Turner
Center for Math/Science Education Research, 265 Enderis Hall
University of Wisconsin-Milwaukee
Milwaukee, WI 53201-0413

Classroom Observation Form
Milwaukee Urban Systemic Initiative (MUSI)

School ______________________________

Date ______________________________

Name of Observer ______________________________

Time Observation:

began __________ ended __________

Grade level /Course ______________________________

Subject area: mathematics or science

Student Information

total number of students ______________________________

males ______		Hispanics ______	
females ______		Asian-Am. ______	
African-Am. ______		Native Am. ______	
Caucasians ______		Others ______	

Teacher Information

Gender __________ Ethnicity/Race __________

Materials, Tools, Technology

1. What materials are students using during the lesson? (e.g. manipulatives, science supplies, animals, plants, rocks, microscopes, calculators, computers,)

2. Are there other materials that only the teacher is using?

Classroom Arrangement

1. Seating arrangement:

_____ Rows _____Groups _____Pairs

_____Other. Please describe or sketch.

2. Are furniture and space appropriate and adequate for instructional purposes? __________ Explain.

Equity

1. Comment on the diversity of gender/race/ethnicity among small groups or pairs of students and seating arrangements.

2. Does the teacher seem to equally engage, encourage, and interact with **all** students regardless of gender / ethnicity / race? Give examples.

Description of the Lesson

Note: Collect copies of handouts or worksheets and attach them to this report.

1. Describe the content of the lesson.

2. What types of tasks and activities were the students involved in? What were they doing?

3. What was the teacher doing throughout the lesson?

4. Describe how the lesson evolved or unfolded.

Connections

1. Describe connections to students' every day lives?

2. Describe connections made to other subject areas?

3. Describe connections made to careers?

Assessment

What assessment strategies did the teacher use during the lesson to gauge student understanding? (e.g. Posing questions to the whole class, questioning small groups, asking students questions one-on-one, having students respond in writing to open-ended questions, giving a test or quiz, etc.) Describe.

Student Focus

1. What was the major way(s) in which student activities were structured? (Major means for a substantial portion of the lesson, e.g. as a whole group, as small groups, as pairs, as individuals.) Describe.

2. How did students participate in the lesson? (e.g. Did they volunteer responses, respond when called on, demonstrate their work on the board or overhead, remain interested and involved in the lesson?)

3. Who did most of the talking during the lesson—the teacher or the students? Describe.

Classroom Observation Checklist

Check the techniques that were explicitly observed during the lesson.

Technique	Check if Observed
Students worked in small groups on collaborative tasks.	
Students used hands-on manipulative materials (e.g. cubes, counters, algebra chips).	
Students used calculators.	
Students used computers.	
Students used mathematical tools or science equipment (e.g. rulers, microscopes).	
Teacher used a calculator.	
Teacher used a computer.	
Teacher showed a video or videodisc to the class.	
The teacher posed open-ended questions for students to respond to orally.	
Students responded in writing to open-ended questions to demonstrate understanding.	
Students wrote reflections in journals or learning logs.	
Students demonstrated their understanding to the whole class on board or overhead.	
Students practiced routine computations or algebraic manipulations.	
Students were engaged in solving open-ended problems (problems with more than one correct answer).	
Students explained different ways to arrive at the same solution (multiple solution strategies).	
Students were engaged in higher order thinking skills.	
Multicultural connections were made to students' culture and/or history.	
Students posed questions or problems for other students to answer or solve.	
Students conducted a structured demonstration of a scientific phenomena or concept.	
Students created their own plan to investigate a scientific question or problem.	
Students used a textbook.	
Students used printed worksheets or workbooks.	
Students used other published materials (e.g. trade books, encyclopedias, magazines)	

Student Group-Interview Protocol
Milwaukee Urban Systemic Initiative (MUSI)

School ______________________________________ Date ____________________

Interview Conducted by:____

(Introduce yourself and explain the purpose of the interview. Here is an example introduction.)

Hi. My name is __________ and I'm visiting your school today with some other people. We've been observing some math and science classes, as well as talking with some of your teachers and with your principal. The reason I wanted to talk with you is because we think that students can teach us a lot about how math and science can be made more meaningful and interesting.

We are interested in your opinions. There are no right or wrong answers. I'm going to run a tape recorder because I can't write fast enough to get everything down on paper that you'll be saying. Don't worry, no one here at the school will listen to the tape—not your teacher, not the principal, not anyone. We want you to tell us what you think and how you feel.

(If there is a notetaker in the room, please introduce him or her also. This is _____________. He/she will be listening and taking notes as we talk.)

(Turn on the tape recorder. Position it in the center of the group.)

1. *For elementary and middle level students*:
   I'd like for each of you to tell me what grade you are in.

   For high school students:
   I'd like for each of you to tell me what grade you are in and what math and science classes you are taking this year.

	Sex: M or F	Ethnicity/Race*	Grade Level/Class
Student 1			
Student 2			
Student 3			
Student 4			
Student 5			
Student 6			

*AA: African-Am.; H: Hispanic; C: Caucasian; AS: Asian-Am.; NA: Native Am.; O: Other (indicate ethnicity/race)

2. We're going to start out with some brainstorming.
   I am going to show you something and then I'm going to ask you to tell me what came to your mind when you saw that. Ready?
   (Wait a moment, then show the card with "math class" written on it. Pause a moment longer.)

   What did you think of when I showed you **math class**?

   (Be sure to get at least one response from every student. Probe interesting responses.)
   Probes: What do you think? What else comes to mind? What do you mean by that?

3. I'm going to show you something else and then I'm going to again ask you to tell me what comes to your mind when you see this word. Ready? *(Wait a moment, then show the card with "science class" written on it. Pause a moment longer.)*

   What did you think of when I showed you **science class**?

   (Be sure to get at least one response from every student. Probe interesting responses.)

   Probes: What do you think? What else comes to mind? What do you mean by that?

4. I would like you to pretend that you are in control of your **math or science** class. You can decide what is taught and how it is taught. You are still a student in the class, but you make the plans.

   a. What would you be doing in your ideal **math or science** class?

   b. What would your teacher be doing?

   c. What would you study or learn about?

   d. What kinds of activities would you be doing?

   e. How does this differ from what typically happens in your **math** class?

5. In **math or science** class, if you could choose, would you rather work in groups or alone? Why?

6. A lot of kids wonder why they have to study **math and science** in school. How will it help you with anything outside of school? Can you give me some examples?

7. What kinds of special things—things like counters, containers, tools, equipment, and machines—do you use in your **math and science** classes? What do you use them for?

8. Do you ever use calculators or computers in **math or science** class? How often do you get to use them? What do you use them for?

9. Sometimes I find **math or science** hard. How about you?
   a. What do you do when you are trying to learn some math or science that is hard?
   b. Does anyone at school or at home ever help you with your math or science? Who helps you?

10. Do you think your teachers like **math or science**? How can you tell?

11. Is there anything else you'd like to tell us about your **math or science** classes?

12. Is there anything you would like to ask us?

Teacher Group-Interview Protocol
Milwaukee Urban Systemic Initiative (MUSI)

School ____ Date ____________________

Interview Conducted by:____

(Introduce yourself and explain the purpose of the interview. Here is an example introduction.)

I really appreciate your willingness to participate in this interview about your mathematics and science programs and about MUSI. We are grateful for the opportunity to observe some of the mathematics and science classes in this school, to talk with your principal and some students, and to talk with you.

I will be audiotaping the interview so that I can be free to concentrate on what we are talking about, rather than having to take notes. The recording will be kept confidential. No individual names, or even the name of the school, will be associated with any of your comments.

(If there is a notetaker in the room, please introduce him or her also. This is _____________. He/she will be listening and taking notes as we talk.)

(Turn on the tape recorder. Position it in the center of the group.)

1. I'd like for each of you to state your position in this school and briefly state your responsibilities in the areas of mathematics and science.

   Probes: What grade level? What subject area? How many classes do you teach?

	Gender	Ethnicity/Race*	Teaching Position: Grade/Subject
Teacher 1			
Teacher 2			
Teacher 3			

*AA: African-Am.; H: Hispanic; C: Caucasian; AS: Asian-Am.; NA: Native Am.; O: Other (indicate ethnicity/race)

2. Briefly describe the most exciting mathematics or science lesson that you taught this year.

3. Would you characterize your mathematics or science teaching as standards-based? Why or why not?

4. What do you feel is the most important resource needed in order to make a significant change in improving your students' learning of mathematics or science?

   Probes: What about additional staff? materials? equipment? time? money? staff development?

5. Describe how your students use technology, such as calculators and computers, for learning mathematics and science. What other technologies do they use?

6. Let's talk about monitoring students' progress and understanding in mathematics and science. What kinds of assessment strategies do you use in your classrooms?

7. What efforts are being taken in your school to address the performance gap between white students and minorities in mathematics and science?

8. (a) Describe staff development experiences, including university courses, you have participated in this year that focused on improving your mathematics and science teaching.

   (b) How effective were they and in what way?

9. (a) What opportunities are there for you to discuss your mathematics or science programs and to share ideas and resources with other teachers in your school?

   (b) What opportunities exist at your grade level?

   (c) What opportunities exist across grade levels?

10. (a) Since you are in a first-wave MUSI school, how has MUSI assisted you in improving your mathematics and/or science instruction this year?

    (b) If you have had an opportunity to interact with your MSRT this school year, talk a little about that interaction.

11. Is there anything else you would like us to tell us about your mathematics or science programs or comment on in regards to MUSI?

Principal Interview Protocol
Milwaukee Urban Systemic Initiative (MUSI)

School ______________________________________ Date ____________________

Interview Conducted by:____

Principal Information

Sex (circle one): Male Female

Ethnicity/Race: ______ African-American ______ Hispanic ______ Caucasian ______ Asian-American

______ Native American ______ Other (please indicate) ______________________

(Introduce yourself and explain the purpose of the interview. Here is an example introduction.)

I really appreciate your willingness to participate in this interview about your mathematics and science programs and your involvement with MUSI. We are grateful for the opportunity to observe some of the math and science classes, to talk with some of the teachers and some students, and to talk with you.

I will be audio taping the interview so that I can be free to concentrate on what we are talking about, rather than having to take extensive notes. The recording will be kept confidential.

(Turn on the tape recorder.)

1. (a) Why did your school want to become involved in MUSI?
   (b) How has MUSI been able help you do that?

2. Talk about the strengths and weaknesses of your **mathematics** program.

3. Talk about the strengths and weaknesses of your **science** program.

4. What evidence have you seen that the mathematics and science instruction in this school is having a positive effect on students' learning?

5. What is your school doing to address the performance gap between white students and minority students in mathematics and science?

6. In your judgment, how comfortable are the teachers with implementing standards-based mathematics and science programs? Why do you say that?

7. What support systems are available in your school to help teachers implement standards-based mathematics and science programs?

8. (a) As a MUSI school, what special efforts have been made this year to focus and engage the school staff on implementing standards-based mathematics and science?

   (b) What kinds of staff development efforts have been implemented?

   (c) How effective have they been?

9. What opportunities are there for teachers of different grade levels to get together to work on program development or address areas of concern in mathematics or in science?

10. What kinds of efforts has your school made to engage families in math and science targeted activities or to support families in assisting their children's mathematics and science learning at home?

11. What opportunities does your school provide for students to participate in math and science related activities "beyond the walls" of the school?

12. (a) Comment upon the work of the MSRT (Math/Science Resource Teacher) in your school.

    (b) What types of things has the MSRT done to improve math and science teaching and learning?

    (c) How have you facilitated the work of the MSRT?

13. Describe any changes you plan to make during your second year of being a MUSI school to move your mathematics and science programs forward.

14. Is there anything else that you would like to tell us about your mathematics and science programs or comment on in regards to MUSI?